FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES

FIT PROJECT

TASK REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY CONTRACT NO. 68-01-6056

Hydrogeologic Report
of the Pristine-Cincinnati Drum-
Carstab Site in Reading, Ohio

November 1982

ecology and environment, inc.

International Specialists in the Environmental Sciences

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Introduction

The purpose of the investigation was to determine the types, amounts, and source(s) of contamination in the Pristine-Cincinnati Drum-Carstab area of Reading, Ohio. The subject area is located in Section 33, Township 4, Range 1, in Hamilton County, Ohio (see figure 1).

The Pristine, Inc. facility is located at the end of Big Four Road (see Plate 1). According to records obtained at the Hamilton County Courthouse in Cincinnati, Ohio, the site is owned by Oren and Jane Long and Chester and Pauline Long. The site is approximately 4-1/2 acres in size. The facility has been engaged in the incineration, neutralization, and storage of chemical waste since 1974. The site was an old sulfuric acid plant. The facility has 13 storage tanks ranging in size from 2,000 to 200,000 gallons with a total capacity of 413,000 gallons. The number of drums stored on site has ranged from approximately 7,000 (April 1980) to approximately 1,500 (December 1981). The drums were haphazardly stored with numerous leaking drums and chemical spills onto the soil. The incinerator is an archaic apparatus which is equipped with scrubbers and leaks severely when operating. However, the incinerator is not presently in operation. During the field investigation, a cut off trench and drain with a collection system and filter unit was installed along the west side of the Pristine property. This system was designed to prevent contaminated surface water runoff from reaching Mill Creek. The effectiveness of this system was not determined.

The Cincinnati Drum Service facility is located west of Pristine, Inc. (see Plate 1). The facility is also owned by the Long family. The site is approximately 13 acres in size. Cincinnati Drum recycles and reclaims drums. Presently, thousands of empty reclaimed stacked drums and hundreds of pretreated "empty" drums are located on the property.

The Carstab Corporation (formerly Cincinnati Milicron) is located south of Pristine and Cincinnati Drum at the end of West Street (see Plate 1). The facility is presently owned by the Thiokel Corporation. The size of the property is approximately 33 acres with approximately 20

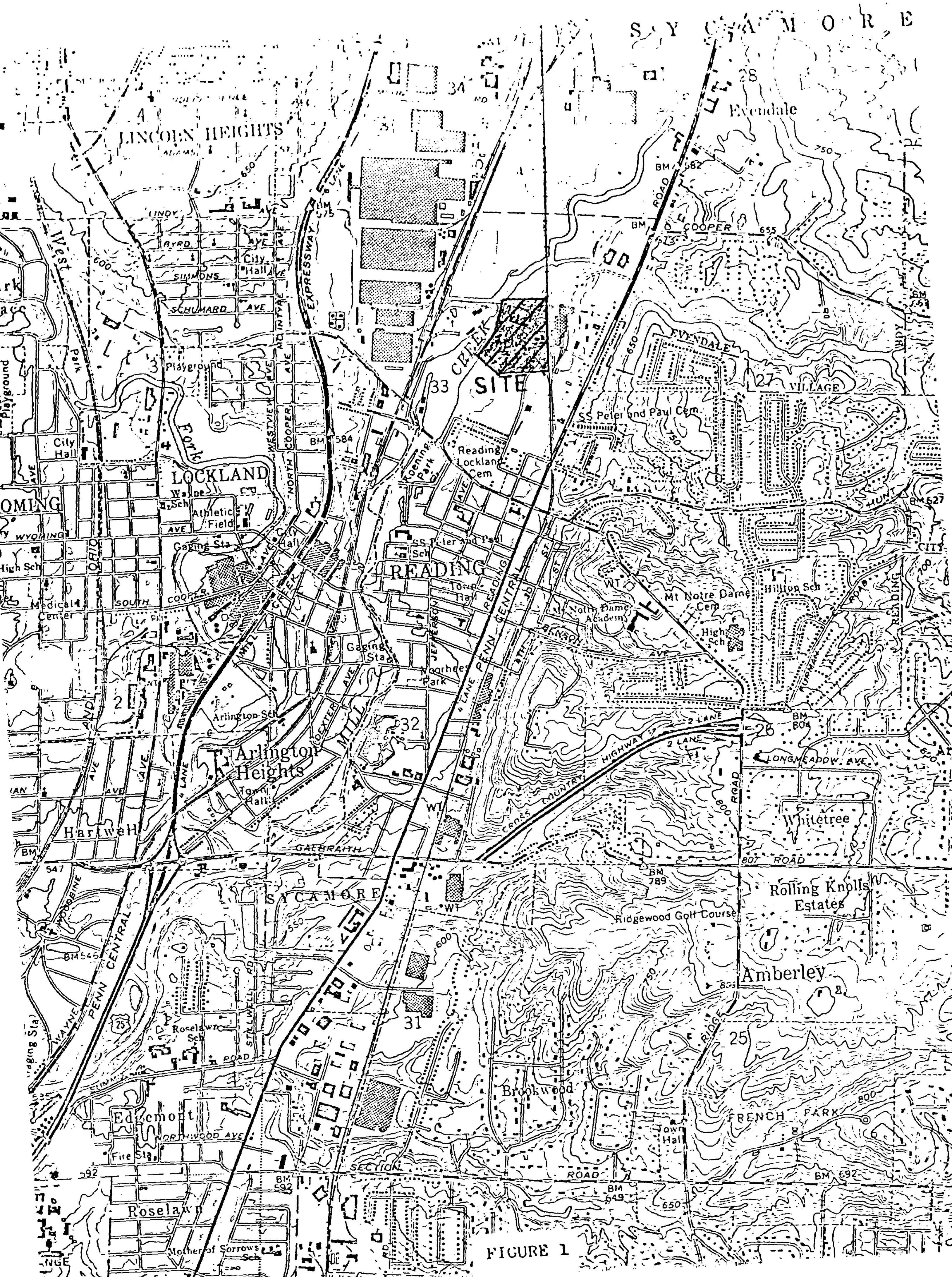

SYCAMORE
LINCOLN HEIGHTS
Evendale
LOCKLAND
READING
SITE
Arlington Heights
Hartwell
Amberley
Whitetree
Rolling Knolls Estates
Brookwood
Edgemont
Roselawn
Ridgewood Golf Course
Mt Notre Dame Cem
SS Peter and Paul Cem
Reading Lockland Cem
FRENCH PARK
PENN CENTRAL
GALBRAITH
ROAD
SECTION
EXPRESSWAY
MILL CREEK
CROSS COUNTRY HIGHWAY

FIGURE 1

acres located within the fenced area. The facility is involved in the production of synthetic stabilizers and plasticizers for industry. Previously, selected liquid wastes were disposed via on-site disposal pits. The disposal pits were located at the northwest corner of the property. The pits consisted of one (1) clear water basin, three (3) acid neutralization ponds, and two (2) settling ponds. Three (3) of the pits have been backfilled and paved while the other three (3) pits have been backfilled and leveled. According to an article in the Cincinnati Enquirer, a former site employee stated that wastes were also disposed in the southwest portion of the site. Wastes were buried as deep as 15 feet in steel and fiber drums.

Several investigations were conducted in the subject area prior to work by Ecology and Environment, Inc. On April 4, 1979, a joint inspection of the Pristine, Inc. facility was conducted by the Ohio Environmental Protection Agency (OEPA) and Pristine personnel. At that time, approximately 7000 to 8000 drums and 300,000 gallons of waste in large storage tanks were on-site.

On June 29, 1979, OEPA personnel discovered a leachate problem in Mill Creek at Big Four and Smalley Roads. The material reported entered Mill Creek from the eastern bank for a distance of approximately 100 yards. A sample of the leachate was collected by the OEPA and analyzed by the Ohio Department of Health labs. The analysis indicated high levels of heavy metals. Further inspections of Pristine and Cincinnati Drum Service were conducted by OEPA personnel on July 16, 18, 25 and 27, 1979.

On April 10, 1980, an inspection of the Pristine, Inc. facility was conducted by USEPA personnel. A total of twelve (12) surface water, groundwater, waste, runoff, spill, and soil samples were taken. The results indicate organic contamination of the drainage ditches and surface soil. Samples taken from three City of Reading wells did not indicate any organic contamination. However, some reported values of arsenic were above drinking water standards.

Area Geology and Hydrogeology

The Mill Creek Valley is a glacial outwash area which consists of more than 200 feet of outwash material. This outwash is generally composed of sand and gravel, however, there are appreciable amounts of clay indicated on area well logs. Throughout the valley, there are two (2) distinct water bearing formations which are separated by at least 50 feet of clay.

The local geologic conditions in the industrial area of Lockland and Reading are similar to those of the Mill Creek Valley. According to local well logs, glacial deposits are 156 to at least 178 feet thick with limestone bedrock underlying the glacial material. The glacial deposits are mainly sand with mixed sand and gravel and interbedded clay layers. The clay layers are on the order of thirty (30) to forty (40) feet thick above the deeper water bearing formation. The clay should prevent recharge to the deep aquifer by direct vertical percolation from the overlying shallow aquifer.

The City of Reading well field is located immediately north of the Cincinnati Drum facility. The Reading wells are screened in the deeper aquifer. According to the Reading well logs, the static water level ranges from 96 to 100 feet deep. Therefore, an unsaturated sand and gravel zone ranging in thickness from 45 to 55 feet is situated between the bottom of the clay and the top of the deep aquifer.

The shallow aquifer is not used in the immediate site area. The extent to which it is presently being used in the Mill Creek Valley is not known.

Soils

The soils in the study area consist of Eldean Urban land complex, 0 to 2 percent slopes (EuA), Stonelick Urban land complex (Ux), and Patton Urban land complex (Ut). The areal extent of the aforementioned soil complexes is shown on Plate 2.

The EuA consists of nearly level land where Eldean soils have been largely altered or covered by grading and digging operations. Most of the area is used for urban development. Buildings, driveways, parking lots, and streets cover about 15 to 30 percent of this complex; fill or borrow areas cover 25 to 50 percent; and 20 to 60 percent is undisturbed areas of Eldean soils. Fill areas consist of one (1) foot to three (3) feet of fill material over undisturbed Eldean soils. The borrow areas expose gravelly material from the substratum and subsoil typical of the Eldean soils.

The Eldean series consists of well drained soils that formed in glacial outwash deposits. These soils are located on terraces in an intermediate position slightly above the recent alluvial soils and generally below the upland till soils. A representative profile consists of a one (1)-foot dark grayish brown to dark brown silt loam surface layer; a two (2)-foot dark brown silty clay loam, gravelly clay loam and gravelly clay, and gravelly coarse sandy loam subsoil; and a brown, very gravelly loamy coarse sand substratum to a depth of five (5) feet. The permeability is moderate in the subsoil and rapid in the underlying stratified sand and gravel.

The Ux consists of nearly level, 0 to 2 percent slopes, soils. As with the EuA, the natural soil has been greatly altered by cuts and fills needed for urban works. The Stonelick series consists of deep, well drained soils formed in stratified alluvium on flood plains. Locally, these soils have a one (1)-foot brown sandy loam surface layer which is underlain by brown and dark grayish brown loamy sand, sandy loam, and sand.

Soils (continued)

The Ut consists of nearly level, 0 to 2 percent slopes, highly altered soil. The Patton series consists of poorly drained soils formed in silty sediments in depressions on terraces and lake plains. The undisturbed sequence consists of a 15-inch thick very dark gray silty clay loam surface layer. The underlying material is mottled dark gray, dark brown, and dark grayish brown silty clay loam which in turn is underlain by mottled grayish brown and light brownish gray stratified silty clay loam and silt loam.

Metal Detection

On August 1, 1980, a metal detection survey was conducted on the Carstab property to determine the presence of buried drums. The initially traversed area was the Carstab employee parking lot. Three (3) areas containing metal and one (1) line of metal were detected. The metal areas may have been low areas filled with construction debris prior to paving of the parking lot. The detected line of metal is a water line connected to a fire hydrant on the Carstab site.

The field west and northwest of the Carstab parking lot was traversed. Twelve (12) metal areas and a line of metal were detected. The line of metal was a continuation of the water line located in the parking lot.

On August 7, 1980, a second metal detection survey was conducted. This survey was conducted in the field adjacent to (south of) Carstab's fenced property. Three (3) areas of metal were detected. A line of metal was detected apparently where an old road (presently buried) had cut across the property. Two (2) small areas of metal were also detected.

No large concentrations of buried metal were detected during the metal detection surveys. However, seventeen (17) areas containing metal were located. The buried metal may be construction debris which could include re-bars and scrap metal or possibly metal drums. Due to depth limitation of the metal detector (five feet) and the fact that many of the reportedly buried wastes were contained in fiber drums, it is possible that wastes were disposed on the southwest portion of the site.

Surface Water

On July 31, 1980, surface water samples were collected in the subject area. A total of six locations were sampled (see Plate 3). A duplicate sample and a blank were also taken for a total of eight (8) samples.

Sample Designation	Time	Location	Comments
S01	11:15 A.M.	Under railroad bridge	Upgradient sample
S03	12:00 P.M.	25' U.S. Cinn. Drum northern fence	Green color, sewer smell
S04	12:25 P.M.	Under north Cinn. Drum bridge	Brown color oil on surface
S05	1:00 P.M.	Cinn. Drum-Carstab fence line	Liquid oozing from east bank of creek
S02	1:30 P.M.	Drainage ditch, at culvert, approx. 1000' west of Mill Creek	Rusty color, rapid flow
S06	3:00 P.M.	Southern Carstab fence line	Downgradient sample
S07			Blank
S08	12:25 P.M.	Under north Cinn. Drum bridge	Duplicate of S04

The eight (8) water samples were shipped to Analytical Research Labs in Monrovia, California for organic analyses.

The organic analysis results are summarized in Table 1. The most significant result of the sampling is the detection of 1,1'-biphenyl, 1,1'-oxybis benzene, and 1,1'-oxybis octane in the downgradient Mill Creek samples. This would appear to result from dark liquid oozing from the east creek bank at the Cincinnati Drum-Carstab property line.

Table 1

Surface Water Samples (ppb) (1)

Compounds	Sample Designation S01	S02	S03	S04	S08	S05	S06	S07
carbon tetrachloride	47							
1,1,1-trichloroethane	450	550						
methylene cloride		23	11					
4,4'-DDT		0.91						
bis(2-ethylhexyl)phthalate			63	13	24	11		14
4,4'-DDE				0.29				
-BHC				0.14	0.3	3.0		
di-n-butyl-phthalate					17			

Tentatively Identified Compounds	S01	S02	S03	S04	S08	S05	S06	S07
1,1,2-trichloroethane	+							
1,2,2-trifluoroethane								
1-ethyl-2-3,5-dimethyl benzene		+						
1-chloro-4-methyl-benzene			+					
acetone						+		
1,1'-biphenyl						+		
1,1'-oxybis benzene						+		
1,1'-oxybis octane							+	

+ = detected

(1) Blanks in table indicate the compound was not detected (ND)

Surficial Samples

On August 6, 1980, surficial soil, waste, and creek bank samples were collected on Pristine and adjoining areas. Initially, six (6) surficial soil samples were obtained from the Pristine property (see Plate 4). The sample designation, sample location and comments follow:

Sample Designation	Location	Comments
S09	1 ft. E. of site road and 40 ft. S. of NW area telephone pole	Gravelly
S10	14 ft. W. of SW corner telephone pole	Sandy
S11	15 ft. N. and 15 ft. W, from SE corner of site	Clayey
S12	E. of incinerator building; 15 ft. S. of stack and 30 ft. W. of eastern fence	Clayey Gravel
S13	22 ft. W. and 32 ft. S. from NE corner of site fence	Sandy
S14	15 ft. S. of northern fence near NW corner telephone pole	Spill

In addition, three (3) more samples were obtained on August 6, 1980. Sample S15 was obtained in the field north of the Pristine-Cincinnati Drum property (see Plate 4). The sample was of some pellets that had been dumped on the City of Reading property. Samples S16 and S17 were taken from the eastern bank of Mill Creek near the Cincinnati Drum-Carstab fence line (see Plate 4). The soil samples were stained gray clay. A slight amount of dark liquid was oozing from the sand and gravel zone above the gray clay at the

S17 location.

The nine (9) samples were shipped to NEIC in Denver, Colorado for extraction. The extracted samples (base-neutral and acid organic fractions) or unextracted samples (volatile organics) were sent to the Central Regional Laboratory in Chicago for analyses. Several of the sample extracts leaked in transit and as a result were not analyzed.

The following summarizes which samples were analyzed or lost:

	Fraction		
Sample Designation	Acid	Base-Neutral	Volatiles
S09	A	A	A
S10	A	L	A
S11	L	A	A
S12	L	A	A
S13	L	A	A
S14	A	A	A
S15	L	A	A
S16	L	A	A
S17	A	L	A

L = Lost

A = Analyzed

The results of the inorganic analyses are shown on Tables 2 and 3. It should be noted that values for chromium in samples S09 and S14 are higher than the other samples. Iron is higher in sample S12 than the other samples. In addition, samples S09, S12, and S14 contain significantly higher levels of lead than the other surficial soil samples.

The results of the incomplete organic analyses are summarized on Table 4. Eight (8) organic compounds were detected. The existence of organic compounds on Pristine is confirmed by this partial analysis.

Table 2

Surficial Samples (ppb)

Metal Analyses

Compound	Sample Designation S09	S10	S11	S12	S13	S14	S15	S16	S16D	S17
Calcium	71,600	11,800	6,100	44,900	18,900	12,100	280,000	130,000	190,000	160,000
Magnesium	19,100	4,100	3,100	9,200	3,800	2,000	32,200	47,800	62,900	41,700
Sodium	8,100	9,400	9,200	15,900	7,900	5,400	2,300	9,600	16,700	13,200
Silver	17	<3	<3	<3	9	<3	<2	11	<3	<3
Aluminum	25,000	27,000	39,000	32,000	34,000	34,000	2,400	49,000	81,000	8,100
Boron	>9,200	>9,000	>8,700	>8,500	>7,400	>9,900	>7,700	>8,000	>9,100	>9,800
Barium	530	380	430	500	330	1,100	860	300	530	540
Beryllium	2	<1	2	6	2	3	<1	3	3	3
Cadmium	20	14	15	27	16	18	10	24	25	21
Cobalt	<5	11	11	15	16	7	5	27	6	<5
Chromium	580	130	61	310	59	590	33	110	130	110
Copper	220	82	80	320	62	240	41	120	230	210
Iron	47,000	51,000	20,000	103,000	21,000	33,000	3,300	27,000	42,000	46,000
Manganese	400	440	700	1,300	410	74	88	630	1,000	910
Molydenum	160	120	120	180	100	180	57	170	210	220
Nickel	140	54	62	110	120	35	<23	180	49	<30
Lead	1,900	640	340	1,700	350	2,400	170	440	480	430
Titanium	3,900	2,500	3,100	2,900	2,000	7,800	160	2,800	4,500	6,100
Vanadium	84	54	86	900	89	75	29	200	170	210
Yttrium	25	<5	8	10	22	<5	<4	25	<5	<5
Zinc	450	210	150	1,600	110	260	<39	170	140	130

Table 3

Surficial Samples (ppm)

Inorganic Analyses

	Sample Designation									
Compound	S09	S10	S11	S12	S13	S14	S15	S16	S16D	S17
Thallium	4.2	11	13	12	17	26	10	20	22	35
Selenium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic	<2	2.5	5.0	8.6	6.3	3.5	8.3	4.4	4.7	5.0
Antimony	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Mercury	12.30	7.25	0.27	4.09	0.23	4.88	10.26	0.03	0.07	0.19
Sulfate	3.8	0.5	<0.5	4.8	19.5	16.9	<0.5	4.5	4.2	1.4
Chloride	<0.5	<0.5	<0.5	7.7	<0.5	<0.5	<0.5	<0.5	<0.5	1.7
Nitrate	3	11	<3	21	7	5	4	15	11	8
Fluoride	.89	38	32	75	108	34	13	130	154	20

Table 4

Surficial Samples (ppb)

Organic Analyses (1)

Compound	Sample Designation S09	S10	S11	S12	S13	S14	S15	S16	S16D	S17
methylene chloride	1,100	1,800				1,300	1,100			4,100
1,2-Dichloroethane	10									
trichlorofluoromethane		5.0								
tetrachloroethylene		870				9.5	3.5			
trichloroethane						4.7				
trichloroethylene						24	10			
phenol	200									
p-tert-butyl phenol	3,200									

(1) Blanks in table indicate the compound was not detected (ND)

Boring/Well Installation

During the periods of January 6-9, 1981 and January 12-15, 1981, eleven (11) borings were drilled and ten (10) groundwater monitoring wells were installed in the subject area. The drilling/well installation work was subcontracted to The H.C. Nutting Company.

Drilling/well installation work was advanced with a CME 750 drill rig using 3-1/4 inch inner diameter (I.D.) hollow stem augers. Soil samples were collected with a 1-3/8 inch I.D. split spoon sampler or a 3-inch nominal diameter shelby tube. The drill rig and accessories were steam cleaned prior to commencement of work on the project. The split spoon samplers were decontaminated between samples with clean water and an acetone rinse. The augers and cutting bit were decontaminated between borings with a high pressure water wash and a rinsing with acetone.

The groundwater monitoring wells were constructed of five (5)-foot stainless steel screens. The slot size of the screens was 0.026 inch. The riser pipe consisted of two (2)-inch I.D. galvanized pipe. Vented locking caps were installed on the pipe. All well materials were rinsed with acetone and allowed to air dry prior to well construction. The well screen filter material was comprised of natural sand and/or clean silica sand. A bentonite pellet seal was emplaced above the sand. The remainder of the annulus was backfilled with cement grout.

The boring/well locations are shown on Plate 5. The boring logs and well design information are contained in the Appendix.

Site Geology

Based on the eleven (11) borings by the H.C. Nutting Company, E-1 through E-11, and the field logs of seven (7) borings, C-1 through C-7, by Carstab's consultant, Pedco, (see Plate 5 for boring/well locations and the Appendix for boring logs), the site geology consists of up to six (6) layers. (See Plate 8 for geologic cross - sections).

Generally, the encountered overburden sequence is comprised of a top layer of dark brown, sandy clay top soil or disturbed fill material. The thickness of this layer varies from 0.0 to 2.5 feet. The second layer is a brown, sandy, silty clay with a trace of gravel. This layer is 0.0 to 13.5 feet thick. The third layer consists of brown, medium sand with a trace of gravel. This layer is 0.0 to 15.0 feet thick. The fourth layer is comprised of gray, silty clay with a trace of gravel. The thickness of this layer ranges from 0.0 to 4.5 feet. The fifth layer is a gray, medium to coarse sand with a trace of gravel. This layer varies in thickness from 0.0 to 10.5 feet. The last encountered layer is composed of gray silty clay. Up to 19.5 feet of this layer was encountered.

Several variations in the aforementioned sequence are worthy of comment. The borings located on the northeast portion of the site, E-4, E-5, E-6, E-7 and E-8, did not contain layers four and five. In addition, borings C-2, C-3, and C-4 did not contain layers four and five. Borings C-5, C-7, E-10 and E-11 were not comprised of layers three and four.

Chemical Analyses of Soil

Inorganic chemical analyses of soil borings are summarized in Table 5. The E-1 samples should be representative of background soil. The E-6, E-3, and E-9 samples are representative of Pristine, Carstab, and Cincinnati Drum-Carstab soils, respectively. The most significant results areas follows:

1. Aluminum was found in all samples. However, the values of 1840 ppm found in sample E-6 (5.0-6.5) and 1120 ppm found in E-9 (5.0-6.2) are significantly higher than that found in the other samples.

2. Arsenic was detected in samples E-1 (10.0-11.5), E-9 (5.0-6.2), amd E-9 (15.0-16.5).

3. Cadmium was detected only in the surface sample (0.0-1.5) of boring E-9.

4. Chromium and mercury were detected only in sample E-6 (5.0-6.5).

5. Iron was found in all samples. However, the values found in samples (5.0-6.2) and (15.0-16.5) of boring E-9 are several times greater than that found in the other samples.

6. The level of lead detected in the surface sample (0.0-1.5) of boring E-9 is significantly higher than any values found in the other samples.

7. Sodium was detected only in sample E-9 (5.0-6.2).

8. The value of titanium reported for sample E-9 (5.0-6.2) is much greater than detected levels, if any, in the other samples.

9. Zinc was detected in all samples. The value of 33.5 ppm found in sample E-3 (10.0-11.5) is significantly higher than that found in the other samples.

Table 5

Soil Boring Samples - Inorganic Analyses

Concentration (ppm)

Compound	LOD	Well Designation and Sample Depth												
		E-1 5.0-6.5	E-1 10.0-11.5	E-1 15.0-16.5	E-3 5.0-6.5	E-3 10.0-11.5	E-3 15.0-16.5	E-6 2.5-4.0	E-6 5.0-6.5	E-6 10.5-11.5	E-9 0.0-1.5	E-9 5.0-6.2	E-9 10.5-11.5	E-9 15.5-16.5
Aluminum	10	430	400	250	120	300	320	660	1,840	600	250	1,120	360	220
Arsenic*	.8	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	.9
Barium	6	18	51	22	ND	12	8	34	17	25	16	48	ND	10
Cadmium*	.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	.2	ND	ND	ND
Calcium	30	83,500	67,500	72,400	56,700	44,000	103,000	2,300	8,230	37,000	115,000	2,590	78,900	111,000
Chromium*	.9	ND	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND	ND
Cobalt	.4	1.6	.5	.7	ND	1.3	.5	ND	.3	1.7	.4	ND	ND	1.0
Copper*	.9	1.6	5.5	3.7	1.0	2.6	6.5	2.8	6.4	2.8	3.1	3.4	ND	6.8
Iron	10	470	1,100	960	1,140	490	1,210	120	880	300	490	3,760	1,340	3,420
Lanthanum	2	45	32	45	29	20	180	7	18	61	120	12	98	124
Lead*	2	3	4	6	3	3	3	ND	3	2	37	7	ND	3
Magnesium	20	13,600	11,300	11,300	16,900	11,900	22,300	480	470	12,900	26,500	120	17,200	27,100
Manganese	.8	241	346	224	145	165	283	52.1	22.5	113	238	10	119	260
Mercury*	.2	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND	ND
Nickel*	.8	2.2	ND	.9	1.0	1.8	ND	ND	1.0	1.1	1.1	ND	ND	.8
Potassium	10	200	210	160	380	250	210	420	300	170	130	340	90	140
Scandium	.2	.6	.3	.7	ND	ND	.4	ND	.5	ND	ND	.3	.2	.5
Silica	1	ND	ND	ND	ND	ND	ND	60	220	80	ND	280	ND	ND
Sodium	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	800	ND	ND
Strontium	.6	78.7	91.3	93.9	24.3	48.7	77	3.7	13.4	19.5	95.8	19.1	66.4	65.6
Titanium	1	2	ND	ND	2	2	ND	1	2	3	2	144	2	ND
Vanadium	.9	1.1	.9	1.0	1.2	1.3	1.3	ND	2.8	1.3	ND	1.0	.9	1.2
Yttrium	.7	5.6	6.5	9.9	4.3	5.6	7.5	1.3	4.5	3.5	3.0	10.7	4.2	9.7
Zinc*	.6	3.1	2.2	2.9	14.1	33.5	2.6	2.7	5.0	3.6	9.0	1.4	2.7	5.1
Zirconium	.6	1.3	1.4	2.9	ND	1.5	.9	ND	ND	ND	ND	2.6	ND	ND

* = Priority Pollutant

LOD = Limit of Detection

Organic chemical analyses of soil boring samples are summarized in Table 6. The most significant results are as follows:

1. 1,2 dichlorobenzene was detected in both E-3 and E-9 borings.

2. Toluene was detected in all samples except the blank.

3. 2-butanone and methyl ethyl ketone were detected in all samples including the blank and thus were probably introduced by the laboratory.

4. PCB-1260 was detected in the surface sample (0-1.5) in boring E-9.

5. Methylene chloride was found in all samples, including the blank. Its presence is probably due to contamination of the bottles or introduction by the laboratory. The value of 585 ppm found in boring E-9 is significantly higher than that found in the other samples.

6. Boring E-9 (15-16.5) contains five (5) aliphatic hydrocarbons containing from 11 to 19 carbon atoms. These materials are common to light oils such as kerosene and fuel oils.

.ble 6

Soil Boring Samples - Organic Analyses (ppm) (1)

Priority Pollutants		Well Number and Sample Depth												
	Blank	E-1	E-1	E-1	E-3	E-3	E-3	E-6	E-6	E-6	E-9	E-9	E-9	E-9
		5.0	10.0	15.0	5.0	10.0	15.0	2.5	5.0	10.0	0.0	5.0	10.5	15.0
Compounds		-6.5	-11.5	-16.5	-6.5	-11.5	-16.5	-4.0	-6.5	-11.5	-1.5	-6.2	-11.5	-16.5
1,2-dichlorobenzene					0.77								<10	
bis(2-ethyhexyl) phthalate				0.589										0.94
di-n-butyl phthalate		0.5		<10	<10	<10					0.9			1.97
methylene chloride	8	120	136	65	35	130	132	98	76	116	98	109	585	164
trichlorofluoromethane									7					
toluene		0.4	2	2.4	3	1	1	3	4	1.4	1	3	4	2
endosulfan-I												0.01		
heptachlor	0.001													
PCB-1260											0.03			
Tentatively Identified Compounds														
2-butanone	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3-methyl-2-butanone														+
isoquinoline					+									
1,1'-oxybis-benzene					+									
2-butoxyethyl-butyl phthalate						+						+		
butyl-2-methyl-propyl phthalate												+		
4-hydroxy-4-methyl-2-pentanone														+
2,6,10,14-tetramethyl pentadecane														+
undecane														+
5,8-diethyl dodecane														+
5-propyl-tridecane														+
4,8-dimethyl-undecane														+

+ - Detected

(1) Blanks in table indicate the compound was not detected (ND)

Site Hydrogeology

The sand and gravel above the gray clay is considered to be the shallow aquifer in the area. The following is a discussion of groundwater conditions in this aquifer.

Permeabilities (K) of the aquifer materials were determined on four (4) samples (see Table 7). The values for K ranged from 3.7559 x 10^{-4}cm/sec to 8.0696 x 10^{-4}cm/sec A grain size analyses of the aquifer material (see Table 9) indicates 5% gravel, 81% sand, 7% silt, and 7% clay. The aquifer material was usually classified as a brown fine to coarse sand with gravel.

Potentiometric maps (Plates 6 and 7) of the shallow aquifer were prepared utilizing water level measurements taken on January 19, 1981 and December 8 and 9, 1981 respectively. Plates 6 and 7 indicate that the groundwater flows toward the southwest. However, a groundwater mound appears to be located on the northwest corner of the Carstab property. The hydraulic gradient is between 0.030 and 0.023. This aquifer is the same one that discharges above Mill Creek.

It should be noted that the potentiometric surface and groundwater flow are dynamic. They vary seasonally in response to infiltration and discharge; therefore seasonal fluctuations in groundwater levels occur.

An approximation of the groundwater velocity (v) in the shallow aquifer may be calculated based on Darcy's equation, which is valid for laminar flow in saturated aquifers, and on several assumptions:

1. $v = K \times I \times \frac{1}{NE}$ where,

   K = hydraulic conductivity,

   I = hydraulic gradient and,

   NE = effective porosity

2. The hydraulic conductivity is 6 x 10^{-4}cm/sec (average of aquifer permeability values).

3. The hydraulic gradient is 0.027.

4. The effective porosity is assumed to be 18%.

Under these conditions, the groundwater velocity is approximately:

$$v \approx 6 \times 10^{-4}\text{cm/sec} \times 0.027 \times \frac{1}{0.18}$$

$$= 94 \text{ feet/year}$$

With this velocity, the water from the former lagoons on Carstab's property could reach the creek within two years. This does not take into account the viscosity of the material disposed of in the lagoons. The hydraulic conductivity of the waste material in the shallow aquifer is probably less than water.

The Mill Creek is not directly connected (hydraulically) with the shallow aquifer. Visual observation along the east bank revealed liquid "oozing" from the sand above the silty clay, down along the silty clay, and into the Mill Creek. Mill Creek appears to be cutting into the silty clay

The permeability of the gray silty clay was determined from two (2) samples (see Table 7). The values for K were 1.2162 x 10^{-8}cm/sec and 2.4007 x 10^{-8}cm/sec. These values indicate that this gray silty clay has extremely low permeability and can be considered an excellent confining unit.

Table 7

Constant Head Permeability Test Data

Hole No.	Sample No.	Depth (Ft.)	Density (Lbs./ft.)	Total Head P.S.I.	Initial (I) Final (F) Natural W.C. (%)	(K) Cm./Sec.	Material Description
1	6	20-21.5	119.1	1.01	9.0 (I) 13.5 (F)	7.2041 X 10-4	Brown fine to coarse sand with gravel, wet - medium dense
5	6	20-21.5	108.5	1.01	9.3 (I) 19.0 (F)	3.7559 X 10-4	Brown fine to coarse sand with gravel, moist - medium dense
7	S-1	5-7	92.1	1.5	23.3 (I) 28.0 (F)	2.4027 X 10-5	Brown clayey silt trace small roots, moist - medium stiff
7	4	20-21.5	103.7	1.01	9.8 (I) 19.6 (F)	8.0696 X 10-4	Brown fine to coarse sand with gravel, moist - loose
7	S-3	28-30	97.4	70.9	27.8 (I) 28.8 (F)	1.2162 X 10-8	Gray clay with silt lenses, moist - stiff
10	S-1	5-7	104.5	10.8	13.1 (I) 22.0 (F)	2.9201 X 10-7	Gray and brown silty fine to medium sand
10	S-2	14-15	120.8	16.0	15.3 (I) 15.3 (F)	2.4007 X 10-8	Brown sandy silty clay with gravel moist - stiff
11	4	10-11.5	117.5	1.01	13.3 (I) 14.6 (F)	4.4114 X 10-4	Brown fine to coarse sand with gravel, moist - medium dense

Table 8

Falling Head Permeability Test Data

Hole No.	Sample No.	Depth (Ft.)	Dry Density (Lbs./ft.)	Initial (I) Final (F) Natural W.C. (%)	(K) Cm./Sec.	Material Description
7	S-2	10-12	109.9	15.0 (I) 18.3 (F)	9.2676 X 10-5	Brown sandy silty clay trace gravel, moist - stiff

Table 9

Grain Size Test Data

Hole No.	Sample Number	Depth (ft.)	% Gravel	% Sand	% Silt	% Clay
1	1	0-1.5	0	26	42	32
	2	2.5-4	0	56	30	14
2	3	5-6.5	8	85	4	3
	4	10-11.5	7	84	5	4
	5	15-16.5	34	58	5	3
3	2	2.5-4	3	72	12	13
4	7	20-21.5	0	28	48	24
5	3	5-6.5	4	40	30	26
	8	30-31.5	0	1	15	84
7	2	2.5-4	0	39	27	34
	3	15-16.5	12	73	8	7
8	6	16-16.5	5	81	7	7
10	1	0-1.1	3	41	29	27
	2	2.5-4	0	19	50	31
11	3	5-6.5	10	43	41	16

Groundwater Sampling Analyses

On January 15, 1981, groundwater monitoring wells E-1 through E-4, E-6, E-9 through E-11, and C-1 through C-7 were developed by bailing with stainless steel bailers. The bailers were decontaminated between wells with acetone and allowed to air dry.

On January 19 and 20, 1981, at least two volumes of water were removed form all the wells at the site except E-7 and E-8 which were dry. The sample concentration information is summarized on Table 10.

The groundwater sample results are summarized in Tables 11 and 12. The most significant of the metals results in Table 11 are the chromium, beryllium, zinc and arsenic levels found in all samples. It should be noted that many organic extracts were broken in transit from the CRL to a Viar contractor and, therefore, the results in Table 12 are not complete. The most significant organic results are the various chlorinated ethanes found in E-4 and the number of compounds found in E-11.

The groundwater monitoring wells were resampled on December 8 and 9, 1981 due to the breakage of groundwater samples obtained on January 20, 1981. The wells were bailed prior to sampling. The sample concentrations are shown on Table 10. Samples sent as medium concentration had a black, oily appearance. The results of the second sampling are summarized in Tables 13 and 14 for inorganic and organic analyses, respectively. The organic analyses detection limits were in parts per million (ppm) and parts per billion (ppb) for medium and low hazard samples, respectively.

The most significant second sampling results for inorganics are the consistently elevated levels of many elements detected in wells C-4 and E-4. The most significant organic analyses are:

1. The number of compounds found in C-4.

2. The existence of several priority pollutants in C-2, E-4, E-6, E-7, and E-11.

3. The detection of 24 priority pollutants. Of these pollutants, methylene chloride is apparently.

Groundwater Sampling Analyses continued

a lab or packaging introduced contaminant, toluene is a sample bottle or lab introduced contaminant, and vinyl chloride may be introduced by the well casing material (PVC) of C-7. The remaining 21 priority pollutants appear to be related to actual groundwater conditions.

Table 10

Sampling Information

Sample Concentration

Well Designation	January 20, 1981	December 8 α 9, 1981
E-1	Environmental	Low
E-2	Hazardous	Medium
E-3	Hazardous	Medium
E-4	Environmental	Low
E-6	Environmental (Total Metals Only)	Low
E-7	None	Medium
E-8	None	None
E-9	Hazardous	Medium
E-10	Hazardous	Medium
E-11	Environmental	Low
C-1	Environmental	None
C-2	Hazardous	Medium
C-3	Hazardous	Medium
C-4	Hazardous	Medium
C-5	Hazardous	None
C-6	Hazardous	Medium
C-7	Hazardous	Low

TABLE 11

GROUNDWATER SAMPLING - INORGANIC SES (FIRST SAMPLING)

CONCENTRATION (PPB)

WELL DESIGNATION

Elements	C-1	E-1	E-1 (Dup.)	C-2	C-3	E-4	E-6	C-7	E-10	E-11	Blank
Aluminum	49,200	87,600	123,000	<10,000	<10,000	58,900	1,300	<10,000	<10,000	76,500	<50
Antimony	<20	<20	<20	<400	<400	<20	<20	<400	<400	<20	<20
Arsenic	800	132	135	<800	<800	52	<20	<800	<800	46	<20
Barium	3,150	959	1,090	<6,000	9,000	448	31	<600	<600	448	<10
Beryllium	28	6	8	<200	<200	4	<2	<200	<200	3	<2
Boron	108	12	15	<10,000	20,000	48	27	<10,000	<10,000	174	<10
Cadmium	<5	6	6	<100	<100	<5	6	<100	<100	<5	<5
Calcium	224,000	524,000	714,000	950,000	510,000	462,000	558,000	500,000	590,000	525,000	216
Chromium	512	146	172	<800	<800	36	242	<800	<800	118	<10
Cobalt	376	112	140	<300	<300	92	20	<300	<300	58	<10
Copper	751	183	222	<800	<800	32	199	<800	<800	119	<20
Iron	1,190,000	237,000	307,000	102,000	14,000	122,000	23,900	41,000	21,000	144,000	55
Lead	<40	154	174	<900	<900	<40	119	<900	<900	<40	<40
Magnesium	606,000	132,000	181,000	1,860,000	400,000	636,000	282,000	130,000	490,000	151,000	<100
Manganese	17,700	3,710	4,650	8,000	1,900	111,000	1,820	26,600	12,100	6,910	<10
Mercury	<1	<1	<1	<200	<200	<1	<1	<200	<200	<1	<1
Nickel	711	216	259	<500	<500	84	449	<500	<500	144	<20
Potassium				81,000	28,000			15,000	73,000		
Selenium	<10	<100	<250	<100	<100	<20	<10	<100	<100	<20	<10
Silver	<20	<20	<20	<400	<400	<20	<20	<400	<400	<20	<20
Sodium	12,300	12,900	11,100	1,400,000	300,000	306,000	141,000	600,000	<200,000	99,900	<100
Strontium				1,800	1,100			1,200	700		
Thallium	<10	<10	<10	<10,000	<10,000	<10	<10	<10,000	<10,000	<10	<10
Tin	52	56	50			<250	56			33	<20
Vanadium	540	138	158	<500	<500	<10	<10	<500	<500	108	<10
Zinc	1,990	14,000	13,000	<1,000	<1,000	24,800	5,090	<1,000	5,000	7,510	26

ble 12
Groundwater Sampling nic Analyses (First Sampling)
Concentration (ppb) (1)

Compounds / Well No.	C-1	(Dup) E-1	E-1	E-4	E-11	Blank	Lab Blank	C-7	C-2	C-3	E-10	Blank
2-chlorophenol					<10							
phenol	<10	<10	<10	<10	<10							
acenaphthene					22							
1,2-dichlorobenzene		<10	<10		40							
naphthalene					<10							
bis(2-ethylhexyl)phthalate	<10	<10	<10	<10	<10	<10	<10					
di-n-butyl phthalate	<10	<10	<10	<10	<10	<10	<10					
di-n-octyl phthalate	<10		<10	<10	<10	<10	<10					
diethyl phthalate	<10	<10	<10	<10	<10	<10	<10					
dimethyl phthalate					<10							
benzo(k)fluoranthene					<10							
chrysene					<10							
pyrene					<10							
benzene	<10	<10	<10		11	<10						
chlorobenzene					15							
1,2-dichloroethane				314	144							
1,1,1-trichloroethane				18	<10							
1,1-dichloroethane				35	<10							
1,1,2-trichloroethane					27							
chloroform					416		<10					
ethylbenzene					15							
methylene chloride	<10		<10	<10	15	<10	<10	46	29	51	52	0.4
tetrachloroethylene					11							
toluene		<10	<10	<10	35		<10		0.6			
trichloroethylene					15							
vinyl chloride					21							
aldrin -endosulfan	<10				0.15	<10						
heptachlor		<10	<10									
∝-BHC	<10	<10	<10		<10							
B -BHC		<10										
g -BHC					<10							
d -BHC						<10						
Tentatively Identified Compounds												
1,1',2',1''-terphenyl	+											
ethanol		+			+							
1-bromo-2-chloro ethane					+							
1,2-dibromo ethane					+							
2-propanone (acetone)										+	+	
benzoic acid									+			

\+ Identified
(1) Blanks in table indicate the compound was not detected (ND)

TABLE 13

GROUNDWATER SAMPLING - INORGANIC ANALYSES (2ND SAMPLING)

CONCENTRATION (PPB)

WELL DESIGNATION

Element	E-1	C-2	E-2	C-3	E-3	C-4	E-4	C-6	E-6	C-7	C-7 (Dup.)	E-7	E-9	E-10	E-11	12/8/81 Blank	12/9/81 Blank
Aluminum	1800	<100	<100	<100	<100	5200	5200	4600	<100	<750	1500	<100	600	300	5400	<100	<100
Antimony	<20	<20	<20	<20	74	27	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10
Arsenic	<10	63	<10	<10	<10	12	21	<10	<10	78	63	<10	<10	<10	15	<10	<20
Barium	200	<100	<100	100	100	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	100	<100
Beryllium	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Boron	430	420	500	200	510	890	1200	680	520	300	300	140	820	550	630	<100	280
Cadmium	<1	3.9	<1	<1	<1	1.1	1.6	8.8	<1	<1	<1	<1	2.7	<1	<1	<1	<1
Chromium	20	70	50	20	92	100	180	60	60	40	60	80	70	70	50	20	30
Cobalt	<50	90	<50	270	110	570	670	200	<50	<50	50	90	<50	<50	100	<50	<50
Copper	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Iron	5300	2100	460	<50	550	284,000	505,000	72,000	750	31,000	30,000	50	160	70	680	<50	<50
Lead	10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese	400	950	<10	<10	30	214,000	208,000	15,000	190	21,000	20,700	750	5200	410	3460	<10	<10
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	<40	90	<40	<40	120	270	500	120	50	55	100	240	110	110	80	<40	<40
Selenium	<2	<2	2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Silver	<10	<20	<10	<10	<10	<10	20	<10	<10	<10	<20	<20	<10	<10	<20	<20	<20
Thallium	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Tin	<20	380	280	62	278	385	1010	140	164	154	119	332	114	183	33	<20	<20
Vanadium	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Zinc	2250	40	30	<10	50	4700	9500	70	8400	30	60	2350	130	230	2600	20	10

TABLE 14
Groundwater Sampling Organic Anal (1)
Concentration (ppb)

IDENTIFIED ORGANIC COMPOUND	WELL								
	E - 1	C - 2	E - 2	C - 3	E - 3	C - 4	E - 4	C - 6	E - 6
acenaphthene						33,000			
1,2,4-trichlorobenzene		<10,000				20,000			
hexachlorobenzene		25,000							
hexachloroethane		270,000							
1,2-dichlorobenzene						24,000			
2,4-dinitrotolune						23,000			
hexachlorobutadiene		1,000,000							
N-nitrosodi-n-propylamine						87,000	200		
bis(2-ethylhexyl)phthalate									
di-n-butylphthalate						40,000			
di-n-octylphthalate	17					44,000	17		
benze(a)pyrene/chrysene						50,000			
pyrene						40,000			
1,2-dichloroethane									1,800
1,1,1-trichloroethane									
1,1-dichloroethane							85		
chloroform									
1.2-trans-dichloroethylene									
1,2-dichloropropane									195
methylene chloride			<1,000						
tetra chloroethylene									
toulene	125	1,000				2,100	23		38
trichloroethylene									
toluene									
trichloroethylene									
vinyl chloride									
TENTATIVELY IDENTIFIED COMPOUNDS									
hexahydro-2 hazepin- 2 one							+		

\+ Identified
(1) Blanks in table indicate the compound was not detected (ND)

TABLE 14
Groundwater Sampling Organic Analyses (1)
Concentration (ppb)

IDENTIFIED ORGANIC COMPOUND	WELL							
	C - 7	C - 7 (DUP)	E - 7	E - 9	E - 10	E - 11	12/8/81 BLANK	12/9/81 BLANK
acenaphthene								
1,2,4-trichlorobenzene								
hexachlorobenzene								
hexachloroethane								
1,2-dichlorobenzene								
2,4-dinitrotolune								
hexachlorobutadiene								
N-nitrosodi-n-propylamine	14							
bis(2-ethylhexyl)phthalate	15	15					32	
di-n-butylphthalate								
di-n-octylphthalate								
benze(a)pyrene/chrysene								
pyrene	230	210				65		
1,2-dichloroethane			1,200					
1,1,1-trichloroethane	2,000	1,700						
1,1-dichloroethane						21		
chloroform	80	43						
1.2-trans-dichloroethylene								
1,2-dichloropropane								
methylene chloride						10		
tetra chloroethylene	48	24				31	24	330
toulene						20		
trichloroethylene	73	73						
toluene								
trichloroethylene								
vinyl chloride								
TENTATIVELY IDENTIFIED COMPOUNDS								
hexahydro-2 hazepin- 2 one							+	

\+ Identified
(1) Blanks in table indicate the compound was not detected (ND)

Summary, Conclusions, and Recommendations

Metal detection surveys, surface water sampling, surficial sampling, auger borings with soil sampling, installation of groundwater monitoring wells, measurement of groundwater levels and collection of groundwater samples were the field investigative techniques utilized to determine the types, amounts, and sources of contamination in the Pristine-Cincinnati Drum-Carstab area of Reading, Ohio.

The metal detection surveys suggest the presence of buried metal in several areas on Carstab property. The type and/or form of metal (e.g. re-bars, scrap metal, or drums) could not be determined.

The analyses of surface water samples from Mill Creek indicates organic contamination at the Cincinnati Drum-Carstab property line. The source of this contamination appears to be a dark liquid oozing from the east creek bank.

The surficial sample analyses on Pristine indicates elevated levels of chromium, iron, and lead. The existence of organic priority pollutants in Pristine surficial soils is indicated by the sampling analyses.

The drilling of eleven (11) soil borings together with soil sampling provided information regarding the geology and subsurface conditions. The depth of the borings ranged from 16 to 41.5 feet. The encountered overburden sequence consisted of (in descending order) sandy clay topsoil or disturbed fill material, sandy silty clay, medium sand, gray silty clay, medium to coarse sand, and gray silty clay.

Chemical analyses of the soil samples indicate that boring E-9, located on the southwest portion of Cincinnati Drum, contained elevated levels of several inorganics including aluminum, arsenic, cadmium, iron, lead, sodium, and titanium. Cadmium and lead were high in the surface sample, while the other metals were generally higher in the 5.0-6.2 sample. The organics detected were also more pronounced in boring E-9 than the other borings. PCB-1260 was found in the surface sample and five (5) aliphatic hydrocarbons were contained in the soil sample which was saturated (15-16.5).

The permeability of the shallow aquifer material, the saturated sand and gravel above the gray silty clay, ranged from 3.8×10^{-4} cm/sec to 8.1×10^{-4} cm/sec. The aquifer material contains 5% gravel, 81% sand, 7%

and 7% clay. The permeability of the gray silty clay ranges from 1.2 x 10^{-8}cm/sec. to 2.4 x 10^{-8}cm/sec. This layer has an extremely low permeability and can be considered a confining unit.

Ten (10) groundwater monitoring wells were installed in the soil borings. Groundwater levels indicate a shallow flow directon toward the southwest. However, an anomaly on the northwest corner of the Carstab property appears to be a groundwater mound. The hydraulic gradient is between 0.030 and 0.023.

The groundwater sampling analyses of the seventeen (17) groundwater monitoring wells, including seven (7) wells installed by Carstab, provides the following:

1. Both inorganic and organic groundwater contamination are occurring.

2. Groundwater contamination is present on all three (3) sites.

3. The well in the shallow aquifer near the Reading well field (E-11) is contaminated.

4. The abandoned Carstab lagoons are the primary suspected source of groundwater contamination into Mill Creek.

It is recommended that the following be implemented.

1. A groundwater investigation be conducted in the area south of the Carstab fenced area to determine the extent of groundwater contamination.

2. At least quarterly monitoring of the Reading wells numbers 7, 10, and 12 for priority pollutants.

3. Remedial action plans for contaminated groundwater control should be implemented by Carstab. This should include prevention of contaminated groundwater seepage into Mill Creek as well as controlling migration to the southwest.

4. Contaminated soils at Pristine and Cincinnati Drum should be properly removed and disposed.

References

Kaufman, Ben L., Cincinnati Enquirer.
June 10, 1980.

Lerch, Norbert., Hamilton County, Ohio
USDA Soil Conservation Service, Atlas Sheet #22 (Advance Copy),
December 1979, Fairfield, Ohio.

APPENDIX

DRILLING LOG

State Ohio

Site Carstab

Boring No. E1

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod BIoese

Start Date January 6, 1981

Completion Date January 6, 1981

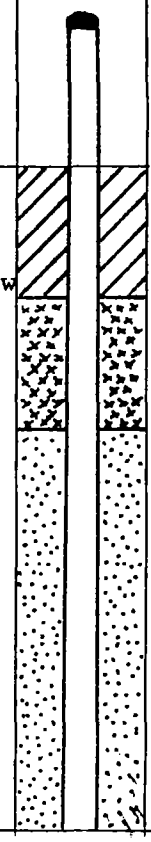
Ground El. 586.40

Groundwater El.
at completion

after ____ days

Total Depth of Boring 21.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Dark brown silty clay	4 4 7	JAR 1	1-3/8" I.D. Split Spoon; 140 lb. Hammer; 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3	Brown sandy clay	2 2 3	JAR 2	Sand seam 3.0-3.5	
	4					
	5					
	6	Brown sandy clay with trace of fine gravel	2 4 5	JAR 3		
	7					
	8					
	9					



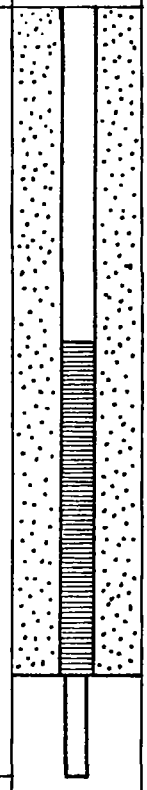
11/13/81

State Ohio

Boring No. E1

Site Carstab

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Gray silty clay with trace of gravel	4 9 11	JAR 4		
	12					
	13					
	14					
	15					
	16	Grayish brown sand, fine to medium, with trace of fines	3 4 10	JAR 5		
	17					
	18					
	19					
	20					
	21	Grayish brown sand, coarse, with trace of fine gravel, maximum 1/2"	17 14 8	JAR 6		
	22				Bottom of hole 21.5	

11/13/81

DRILLING LOG

State Ohio

Site Carstab

Boring No. E2

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 7, 1981

Completion Date January 7, 1981

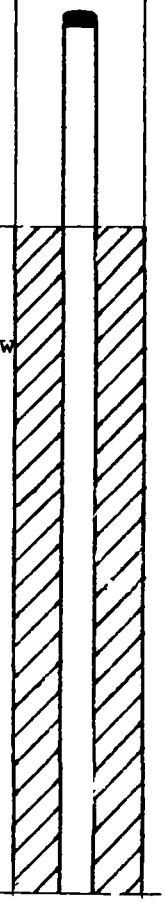
Ground El. 563.31

Groundwater El.
at completion 543.31 (20)

after ____ days

Total Depth of Boring 27.0

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Fill-Black clay/sand & f. gravel	3		1-3/8" I.D. Split Spoon, 140 lb. Hammer; 30" Drop 3-1/4" I.D. Hollow Stem Auger	
		Brown sandy clay with trace of gravel	4	JAR		
	2		4	1		
	3	Brown clayey sand	3	JAR		
			4	2		
	4		4			
	5					
	6	Brown sand, fine to medium, with trace of fine gravel	1	JAR		
			1	3		
	7		1			
	8					
	9					



11/13/81

State Ohio

Boring No. E2

Site Carstab

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Brown sand, fine to medium, with trace of fine gravel	6 15 10	JAR 4		
	12					
	13					
	14					
	15					
	16	Brown sand, medium, with gravel	15 20 23	JAR 5		
	17					
	18					
	19					
	20					
	21	Gray sandy clay with trace of fine gravel (sand lenses)	3 7 7	JAR 6		
	22					
	23				Hit water at 23.0	
	24					
	25	Dark gray sand, coarse, with gravel	14 20	JAR 7		
	26					
	27	Brown silty clay with trace of fine gravel	16	JAR 8		
					Bottom of Hole 27.0	

11/13/81

DRILLING LOG

State Ohio

Site Carstab

Boring No. E3

Drilling Firm H.C. Nutting

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 7, 1981

Completion Date January 8, 1981

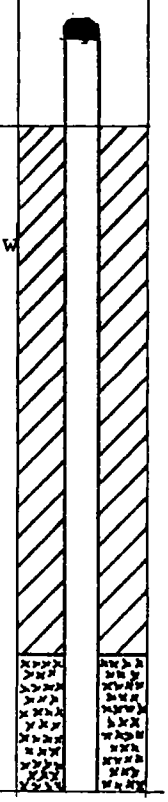
Ground El. 553.88

Groundwater El.
at completion

after ____ days

Total Depth of Boring 21.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Fill-Gravel w/ clay, sand, silt	18		1-3/8" I.D. Split Spoon, 140 lb. Hammer, 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	1	Gray clayey silt	9	JAR		
	2		3	1		
	3	Gray clayey sand, fine to medium	1	JAR		
	3		2	2		
	4		2			
	5					
	6	Gray silty sand, fine to medium with trace of gravel	2	JAR		
	6		3	3		
	7		7			
	8					
	9					

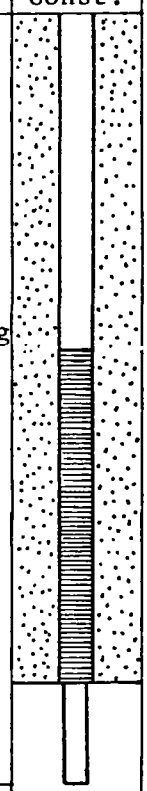


State Ohio

Boring No. E3

Site Carstab

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Dark gray sand, coarse to medium, with fine gravel, and trace of fines	10 14 14	JAR 4	Noticable Odor	
	12					
	13					
	14					
	15				Completed drilling on 1/7/81 at 15.0	
	16	Grayish brown silty clay with trace of fine gravel	6 9 13	JAR 5		
	17				Hit water at 17.5	
	18					
	19					
	20					
	21	Gray clayey silt with fine sand seams	6 13 30	JAR 6		
	22				Bottom of Hole 21.5	

11/13/81

DRILLING LOG

State Ohio

Site Pristine

Boring No. E4

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 12, 1981

Completion Date January 12, 1981

Ground El. 570.91

Groundwater El.
at completion

after ____ days

Total Depth of Boring 26.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown silty clay with trace of gravel	8 8 13	JAR 1	1-3/8" I.D. Split Spoon, 140 lb. Hammer, 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3		5 4 4	JAR 2	some discolored soil	
	4					
	5					
	6	Brown silty clay	2 3 5	JAR 3		
	7					
	8					
	9					

11/13/81

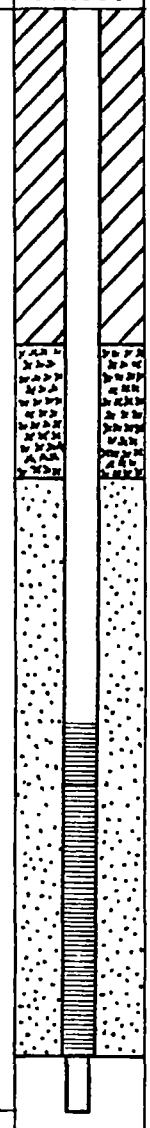
State Ohio

Site Pristine

Boring No. E4

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Brown silty clay	1	JAR		
	11		1	4		
			1			
	12					
	13					
	14					
	15					
		Light brown silty clay	3	JAR		
	16		3	5		
		Grayish brown silty clay	5	JAR 6		
	17					
	18					
	19				Hit water at 19	
	20					
		Light brown sandy clay with	1	JAR		
	21	gray clay and sand lenses	1	7		
			1			
	22					
	23					
	24					
	25					
		Gray silty clay with trace of	8	JAR		
	26	fine gravel	12	8		
			14			
	27				Bottom of Hole 26.5	



11/13/81

DRILLING LOG

State Ohio

Site Pristine

Boring No. E5

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 6, 1981

Completion Date January 6, 1981

Ground El.

Groundwater El.
at completion none
after 2 hours none

Total Depth of Boring 41.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown sandy clay (fill)	24 11 10	JAR 1	1-3/8" I.D. Split Spoon, 140 lb. Hammer, 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3	Reddish brown clayey silt with sand (fill)	2 2 2	JAR 2		
	4					
	5					
	6	Light brown silty clay	2 5 8	JAR 3		
	7				trace of fine gravel	
	8					
	9					

11/13/81

State Ohio Boring No. E5

Site Pristine Page 2 of 3

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Light brown clayey silt with trace of sand	4 4 5	JAR 4		
	12					
	13					
	14					
	15					
	16	Light brown silty clay with fine sand seams	2 6 7	JAR 5		
	17					
	18					
	19					
	20					
	21	Light brown sand, fine, with fines	8 9 6	JAR 6		
	22					
	23					
	24					
	25					
	26	Gray silty clay	3 6 7	JAR 7		
	27					
	28					
	29					

11/13/81

State Ohio Boring No. E5

Site Pristine Page 3 of 3

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	31	Gray silty clay	3 4 6	JAR 8		
	32					
	33					
	34					
	35					
	36		4 5 7	JAR 9		
	37					
	38					
	39					
	40					
	41	Light brown sandy clay	4 8 20	JAR 10		
	42				Bottom of Hole 41.5	

11/13/81

DRILLING LOG

State Ohio

Site Pristine

Boring No. E6

Drilling Firm H.C. Nutting Co.

Type of Drill CME 55

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 13, 1981

Completion Date January 13, 1981

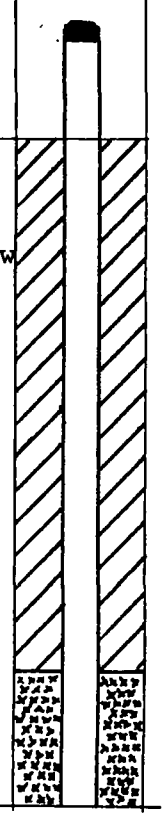
Ground El. 572.23

Groundwater El.
at completion

after ____ days

Total Depth of Boring 21.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown silty clay with trace of fine gravel	4 7 8	JAR 1	1-3/8" I.D. Split Spoon, 140 lb. Hammer, 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3	Brown silty sandy clay	5 10 10	JAR 2		
	4					
	5					
	6	Light brown sandy clay with gravel	4 7 9	JAR 3		
	7					
	8					
	9					

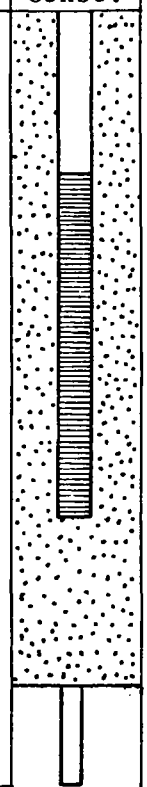


State Ohio

Boring No. E6

Site Pristine

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Light brown silty clay with traces of sand and fine gravel	6 8 12	JAR 4		
	12					
	13					
	14					
	15					
	16	Gray silty clay	4 5 6	JAR 5		
	17					
	18					
	19					
	20					
	21		4 4 6	JAR 6		
	22				Bottom of Hole 21.5	

11/13/81

DRILLING LOG

State Ohio

Site Pristine

Boring No. E7

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 13, 1981

Completion Date January 13, 1981

Ground El. 573.21

Groundwater El.
at completion

after ____ days

Total Depth of Boring 30.0

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Light brown sandy clay	25	JAR 1	1-3/8" I.D. Split Spoon; 140 lb. Hammer; 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2		27			
	3		17			
	4		3	JAR 2		
	5		5			
	6		6			
	7			Shelby Tube 1	Pushed 3" I.D. Shelby Tube	
	8					
	9					

11/13/81

State Ohio

Boring No. E7

Site Pristine

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Light brown sandy clay		Shelby Tube 2		
	12					
	13					
	14					
	15					
	16	Brown sand, medium, with traces of gravel and clay	7 8 11	JAR 3		
	17					
	18					
	19					
	20					
	21	Light brown sand, coarse to medium, with trace of gravel and fines	5 4 5	JAR 4		
	22					
	23					
	24					
	25				Attempted push of shelby tube, refusal 25.0-26.0	
	26			JAR 5		
	27	Light brown silty clay	10 7	JAR 6		
	27.2		8			
	28					
	29	Gray silty clay		Shelby Tube 3	Bottom of Hole 30.0	

11/13/81

DRILLING LOG

State Ohio

Site Cincinnati Drum

Boring No. E8

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 14, 1981

Completion Date January 14, 1981

Ground El. 558.31

Groundwater El.
at completion

after ____ days

Total Depth of Boring 21.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown with black sandy silty clay	13 10 5	JAR 1	1-3/8" I.D. Split Spoon; 140 lb. Hammer; 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3	Grayish brown silty clay with trace of sand	1 1 1	JAR 2		
	4					
	5	Light brown silty clay	2 4 7	JAR 3		
	6					
	7					
	8					
	9	Light brown silty clay with traces of sand and gravel				

State Ohio

Boring No. E8

Site Cincinnati Drum

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Light brown silty clay with traces of sand and gravel	10 14 23	JAR 4		
	12					
	13					
	14					
	15					
		Light brown sandy clay	9	JAR		
	16		5	5		
		Light brown sand, medium to	7	JAR 6		
	17	coarse, with fines				
	18					
	19					
	20					
		Light grayish brown silty clay	4	JAR		
	21		7	7		
			7			
	22				Bottom of Hole 21.5	

11/13/81

DRILLING LOG

State Ohio

Site Cincinnati Drum

Boring No. E9

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 14, 1981

Completion Date January 14, 1981

Ground El. 554.87

Groundwater El.
at completion

after ____ days

Total Depth of Boring 16.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown clay and gravel (fill)	20 17	JAR 1	1-3/8" I.D. Split Spoon, 140 lb. Hammer, 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2	Brown sandy clay with trace of gravel	5			
	3	Brown silty clay with trace of rootlets	5 9	JAR 2		
	4		9			
	5					
	6	Brown sandy clay	12 36 50	JAR 3	Split spoon refusal at 6.2	
	7					
	8					
	9	Gray sand, coarse with gravel			Encountered some gravel 8.5 to 10.0	

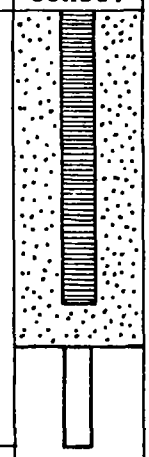
11/13/81

State Ohio

Boring No. E9

Site Cincinnati Drum

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Gray silty clay	3	JAR 4	Hit water at 10.5	
	11	Dark gray sand, fine to coarse, with gravel	16 20	JAR 5	Sample contained black oil material	
	12					
	13					
	14					
	15					
		Gray silty clay with sand	4	JAR	Black stain along	
	16	lenses	7 9	6	sand seams	
	17				Bottom of Hole 16.5	

11/13/81

DRILLING LOG

State Ohio

Site Cincinnati Drum

Boring No. E10

Drilling Firm H.C. Nutting Co.

Type of Drill CME 55

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 15, 1981

Completion Date January 15, 1981

Ground El. 555.52

Groundwater El.
at completion

after ____ days

Total Depth of Boring 16.0

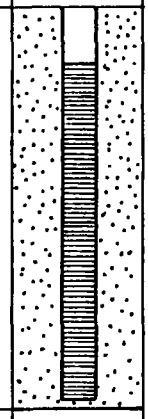
Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Light brown to brown silty clay with traces of sand/gravel	3 3	JAR 1	1-3/8" I.D. Split Spoon; 140 lb. Hammer; 30 " Drop 3-1/4" I.D. Hollow Stem Auger	
	2	Light brown sand, medium, with gravel	11			
	3	Dark brown silty clay with trace of sand	4 5	JAR 2		
	4		6			
	5				Pushed 3" I.D. Shelby Tube	
	6	Brown sandy clay with trace of gravel		Shelby Tube 1		
	7					
	8					
	9				Hit black liquid at 9.5	

State Ohio

Boring No. E10

Site Cincinnati Drum

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
	11	Black gravelly sand, medium to coarse	8 6 3	JAR 3		
	12					
	13					
	14					
	15	Brownish gray silty clay with traces of sand and fine gravel		Shelby Tube 2		
	16				Bottom of Hole 16.0	

11/13/81

DRILLING LOG

State Ohio

Site Cincinnati Drum

Boring No. E11

Drilling Firm H.C. Nutting Co.

Type of Drill CME 750

Driller J. D. Martin

Geologist Rod Bloese

Start Date January 8, 1981

Completion Date January 8, 1981

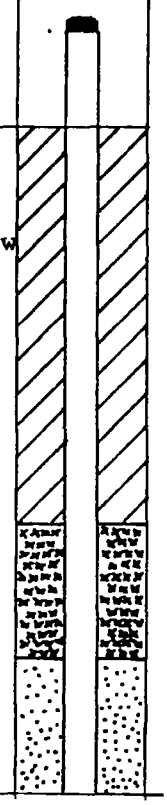
Ground El. 553.79

Groundwater El.
at completion

after ____ days

Total Depth of Boring 16.5

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Ground Surface				
	1	Brown silty clay with trace of sand	3 4 4	JAR 1	1-3/8" I.D. Split Spoon; 140 lb. Hammer; 30" Drop 3-1/4" I.D. Hollow Stem Auger	
	2					
	3		2 2 3	JAR 2		
	4					
	5					
	6	Brown clayey silt with fine sand and trace of fine gravel	1 2 2	JAR 3		
	7					
	8					
	9	Gray sand, coarse to medium, with gravel				

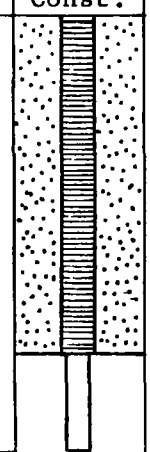


State Ohio

Boring No. E11

Site Cincinnati Drum

Page 2 of 2

Elev.	Depth	Description	Blow Count	Sample No.	Remarks	Well Const.
		Gray sand/coarse to med w gravel	6	JAR 4		
	11	Brownish gray silty clay with	9	JAR		
		trace of sand	10	5		
	12					
	13					
	14					
	15					
		Gray silty clay with trace of	4	JAR		
	16	fine gravel	8	6		
			9			
	17				Bottom of Hole 16.5	

11/13/81

12/09/80 MW-1

well is located about 150' from the railroad tracks and about 25' from the property boundry fence

Depth	blows	description
0-1½	2-2-4	Soil, dark brown, becomes tan and sandy toward bottom with an increased amount of clay
~~2½-4~~		
2½-4	1-2-2	Clay, tan and sandy with decreasing amounts of sand toward bottom; possible iron staining in very sandy zone
5-6½	4-4-7	Clay, tan and sandy with some gravel present
7½-9	6-12-21	Clay, tan with coarse sand and gravel present; hit water table
12½	7-10-14	Clay, tan at top changing to grey toward bottom, some gravel present
12½-14	8-13-14	Clay, tan at top and grey at bottom, some gravel present; gravel more abundant at top portion of sample
15-16½	13-11-11	Clay, grey with some pebbles changing to a medium sand; sand is relatively clean
17½ 19	7-6-6	Sand and gravel that becomes coarser toward bottom; 3 inch clay layer present in mid portion
19-20½	5-5-5	Gravel and coarse sand; possibly some clay present

(well set at 19' depth)

Construction: 10' of 1½" diameter blank over 10' of 1½" diameter, 0.010" slot

12/09/80 MW-2

ft	blows	description
0-1½	8-5-7	Fill, brown and earthy with some limestone gravel and minor amounts of sand
2½-4	6-5-4	Fill, reddish-brown with rock fragm pebbles, and some sand
5-6½	4-3-2	Fill, reddish-brown with some sand
7½-9	3-3-5	Fill, reddish-brown with some sand
10-11½	2-2-3	Fill becoming very sandy toward bottom; sand may be natural
12-14	9-9-11	Sand and gravel with a 1" clay lens at the base; probably hit water table at about 13½ feet
15-16½	9-13-34	Sand with some gravel changing abruptly to a black, chemica saturated sand and gravel
17½-19	13-14-15	Gravel and coarse sand, black chemical saturated
19-20½	10-21-23	Sand and gravel, black chemical saturated, changing abruptly to brown clay with some sand; brown clay is not chemical saturated

Construction: 10' of 1½" diameter blank riser
10' of 1½" diameter, 0.010" slot screen
well set at 19' depth

MW-3 12-16-80

ft	blows	description
0 - 1½	5-6-5	~~Fill~~, dark brown, ~~with some consisting mainly of~~ silt and clay with some gravel
2½ - 4	3-3-3	~~Fill~~, brown ~~consisting mainly~~ of silt and clay with some sand
5 - 6½	3-5-5	~~Fill~~, ~~brown~~, silt and clay changing to tan sand and gravel mixtur
7½ - 9	4-15-16	Sand and gravel, tan color, some silt present
10 - 11½	7-8-8	Sand, tan color, medium to coarse grained, some gravel present
12½ - 14	8-12-15	Sand, tan color, medium to coars grained, gravel present; probably hit water table at about 14 feet
~~15 - 15½~~		
15 - 16½	5-8-12	Sand with some gravel, black chemical saturated throughout entire sample
17½ - 19	8-8-9	Sand, black chemical saturated, changing to a grey silty clay at about 18½ feet
19 - 20½		Shelby Tube - is taken in grey silty clay

Construction: 10' of 1½" diameter casing over 10' of 1½" diameter, 0.010" slot screen; well set at 19½ fe

* Fill may actually represent natural materials.

MW-4 12-17-80

ft	blows	description
0-1½	8-7-6	*Fill, dark brown, with some silt, clay
2½-4	4-2-3	*Fill, brown, sand, silty
5-6½	3-3-4	Sand, tan color, very silty with some clay present
7½-9	6-6-4	Sand, tan color with silt and gravel present, changes abruptly to a black chemical saturated sand
10-11½	6-9-12	Sand and gravel, black chemical saturated; probably at water table at about 10 feet; sample to be analyzed by Pedco
13½-14	13-12-13	Gravel and sand changing to clay; entire sample is black chemical saturated
15-16½	6-11-15	Clay, grey and silty with some gravel present; sample to be analyzed by Pedco
17-18½	—	Shelby Tube - tube taken in silty grey clay

Construction: 10' of 1½" diameter casing over 8' of 1½" diameter, 0.010" slot screen; well set at 17';

*Fill may actually represent natural material.

MW-5 12-17-90

ft	blows	description
0-1½	5-4-8	*~~Fill~~, (brown color), ~~consisting mainly~~ of clay with some sand and grave
2½-4	5-4-5	*Fill, ~~brown color, consisting mainly~~ of clay and silt*
5-6½	4-5-6	Sand with silt and some gravel, dark grey color, most of sam appears to be contaminated
7½-9	5-7-7	Gravel, sand, and some clay; black, chemical saturated; hit water table at about 8½ feet
10-11½	9-13-22	Gravel and sand, black, chemical saturated; sample to be analyzed by Pedco
12-14	4-8-13	Clay with lot of silt and some gravel, grey color, not extensiv contaminated
~~14-16~~	—	~~Shelby Tube; pushed into grey clay, pushed a rock~~
14-16		Clay with some gravel, brown color
16-18		Shelby Tube; pushed into grey clay

Construction: 7' of 1½" diameter casing over 10' of 1½" diameter, 0.010" slot screen; well set at 16'.

* Fill may actually represent natural materia

PedCo

I will be logging in MW-6 and MW-7

Below are the Logs for MW-6

MW-6, (Dec. 17, 1980)

Depth	Blows	Discription
~~0'-1.5'~~		
0'-.5'	~~~	Asphaltic Black Top Road Material
.5'-2.0'	~~	Road Gravel for support
2.5'-4.0'	4-5-6	Fill Material, mostly Clay and silt. Dark Greenish Black
5.0'-6.5'	4-10-16	Coarse Sand, little silt Black, entire sample looks contaminated
7.5'-9.0'	4-7-11	Coarse Sand changing to Sand & Gravel, Entire sample is contaminated. Black Water table reached at approx 8½ft.
10.0'-11.5'	5-3-3	Clay, grey color, with alot of silt and sand present
12.0-12.5		Shelby Tube pushed into ~~mostly clay~~ gravel

MW-6 (Dec 17, 1980)

Depth	Blows	Description
12.5' - 14.0	17-30-43	Sand & Gravel, Black And highly contaminated.
15.0' - 16.5'	5-10-15	Sand & Gravel turns into Clay Clay has a lot of silt and some sand. Clay color is dark grey.
17.5' to 19'	6-11-17	Clay with silt, sand, and little gravel. Clay turns from grey to greenish. The green Clay does not look degraded or contaminated. Clay was never broken.

* Well will go to 17.5 ft.

Well was stinded in and produced water. It's good.

* A sample was taken of the contaminated stratum

* A sample also was taken of the clay layer directly beneath the contamination

Construction: 5' of 1½" diameter casing over 10' of 1½" diameter, 0.010" slot screen.

MW-7 (Dec 17, 1980)

Depth	Blows	Description
0' - 1.0'	~~~	Road Asphalt
1.0' - 2.5'	9-6-5	Fill material (clay) turning to sand & gravel. Fill is dark green to Black and sand is Brown.
2.5' to 4.0'	3-3-4	Fill Material, silts and clay mostly, some sands Green-Brown color
5.0' to 6.5'	4-4-6	Fill Material, mostly clay and silt, Dark Greenish Brown
7.5' to 9.0'	5-7-7	Fill silt and clay, little sand, ~~brt~~ lite Brown
10.0' to 11.5'	3-1-1	Fill clay & silt (lite Brown) changing to fine sand (gray) (no chemical oder) Possibly the water Table was reached
12.5' to 13.0'	7-10-10	Fill mostly silt, some gravel, lite Brown
15.0 to 16.5'	5-9-11	Clay and silt with some gravel very little sand, Dark green-brown, Appears to be fill material still! No oder

MW-7 (Dec 17, 1980)

Depth	Blows	Description
17.5' to 19.0'	8-13-17	Clay & silt with little gravel, still appears to be fill material, No oder Dark greenish color.
20.0' to 21.5'	5-14-18	Same material as above changing to a sand & gravel with a brown color. Sand & Gravel was dry! No oder

Well was sanded in, and it goes to a depth of 20.0 ft.

* A Composite sample was taken at intervals from the split-spoons since there wasn't any visible contamination.

PLATE 1
LOCATION MAP

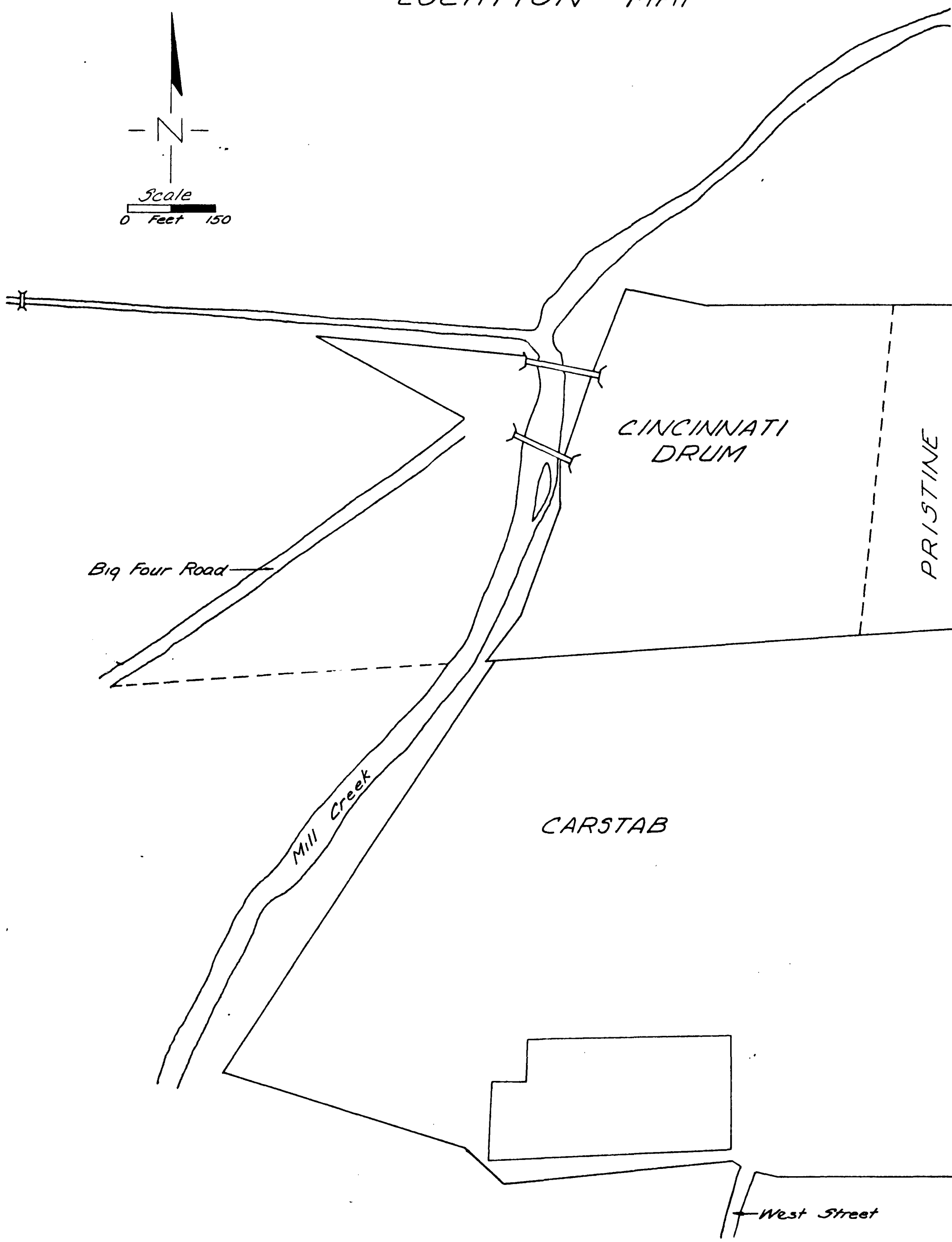


PLATE 1
LOCATION MAP

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et 150

CINCINNATI DRUM

PRISTINE

Road

Mill Creek

CARSTAB

West Street

PLATE 2
SOILS MAP

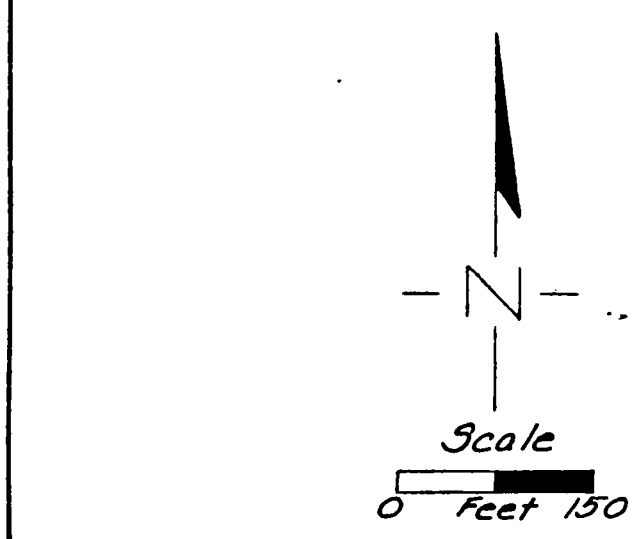


PLATE 2
SOILS MAP

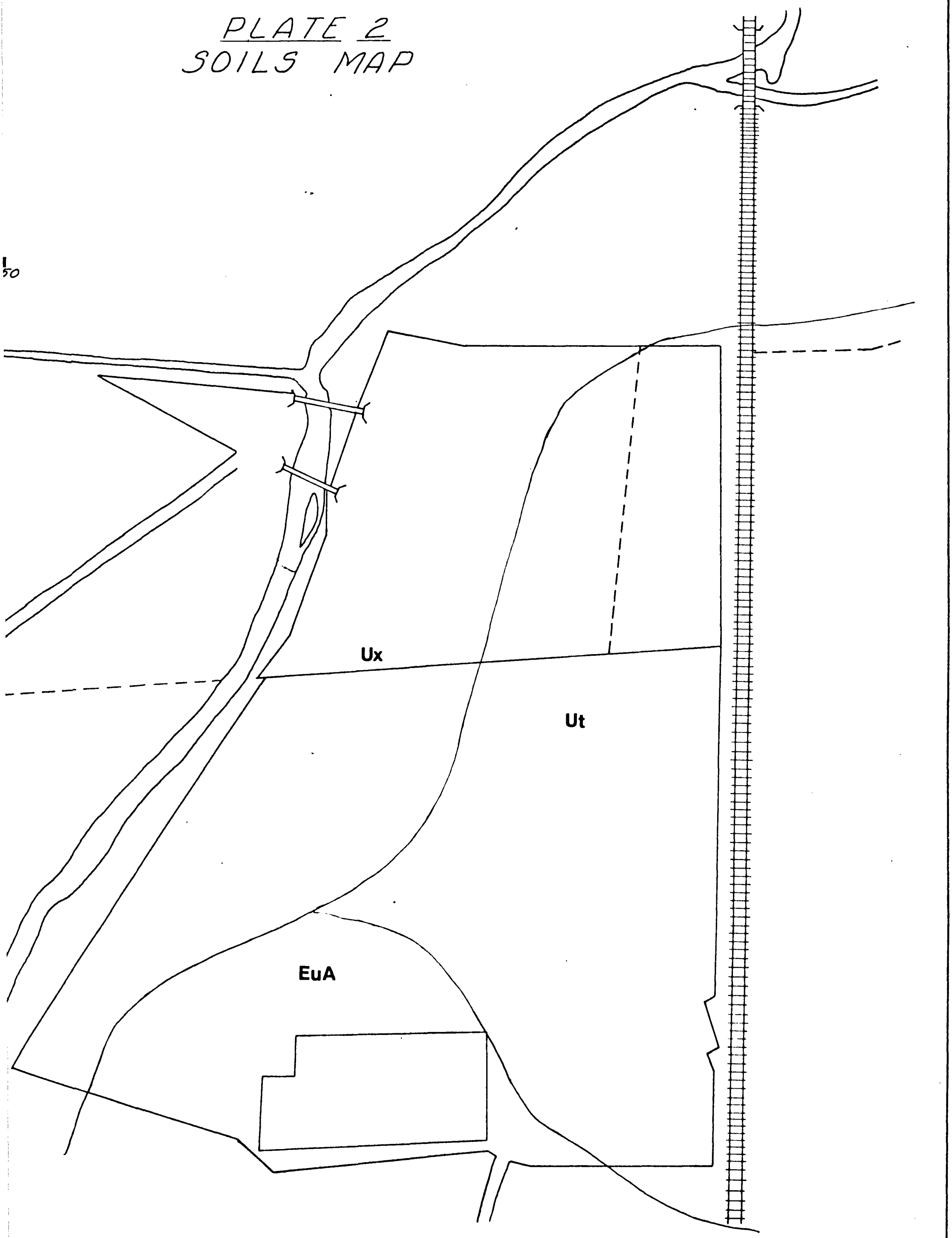


PLATE 3
SURFACE WATER
SAMPLE LOCATIONS

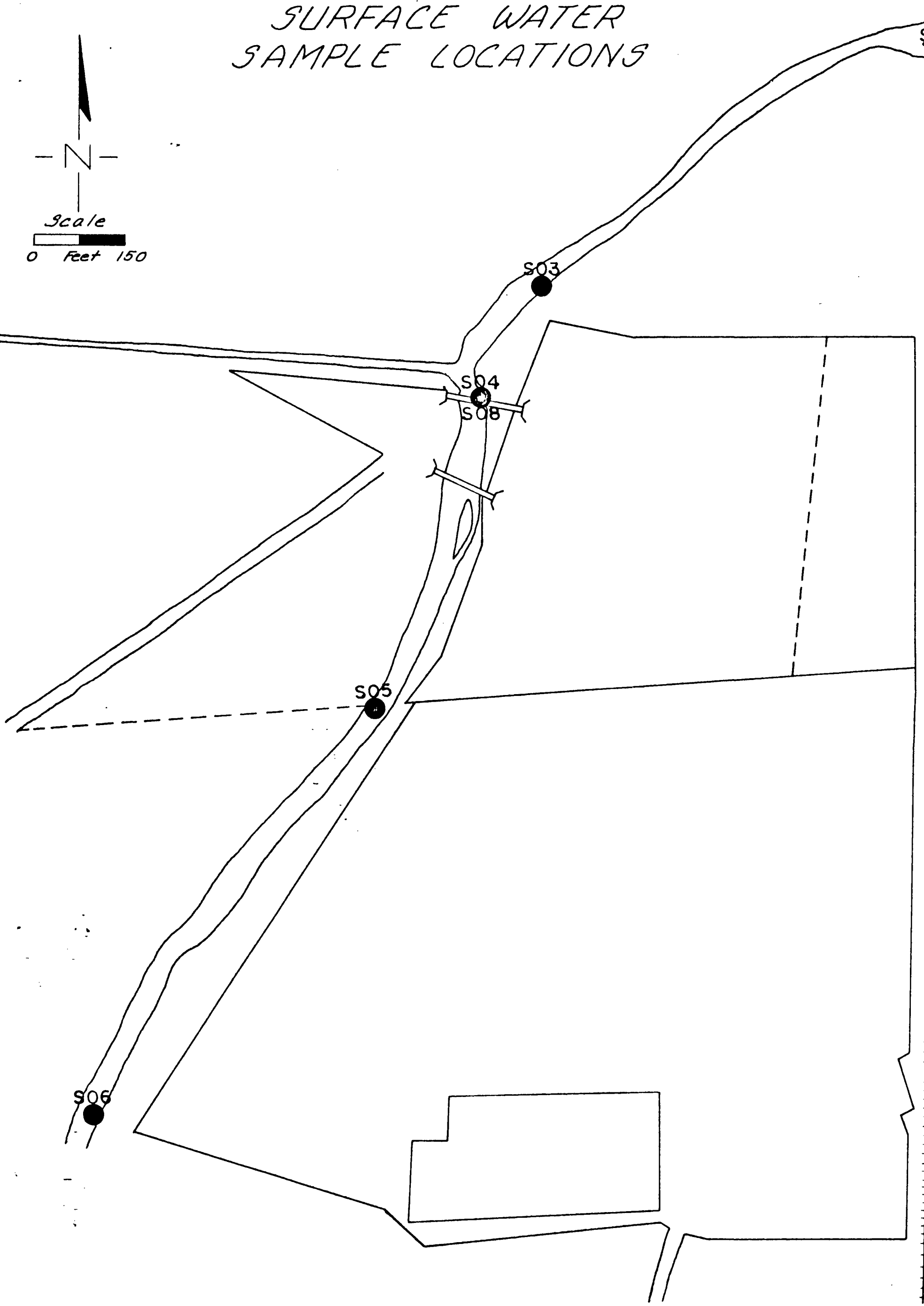


PLATE 3
SURFACE WATER SAMPLE LOCATIONS

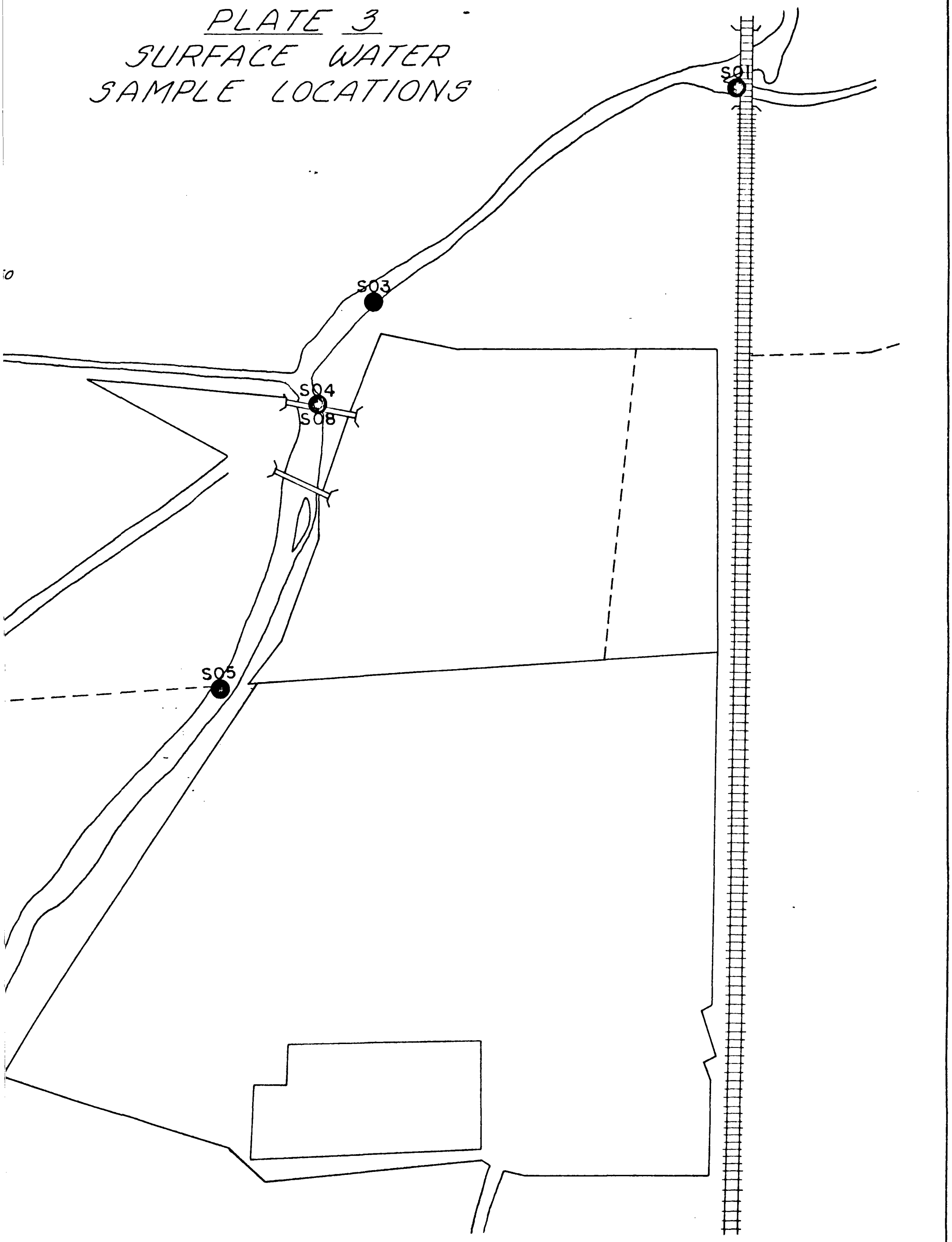


PLATE 4
SURFICIAL SAMPLE LOCATIONS

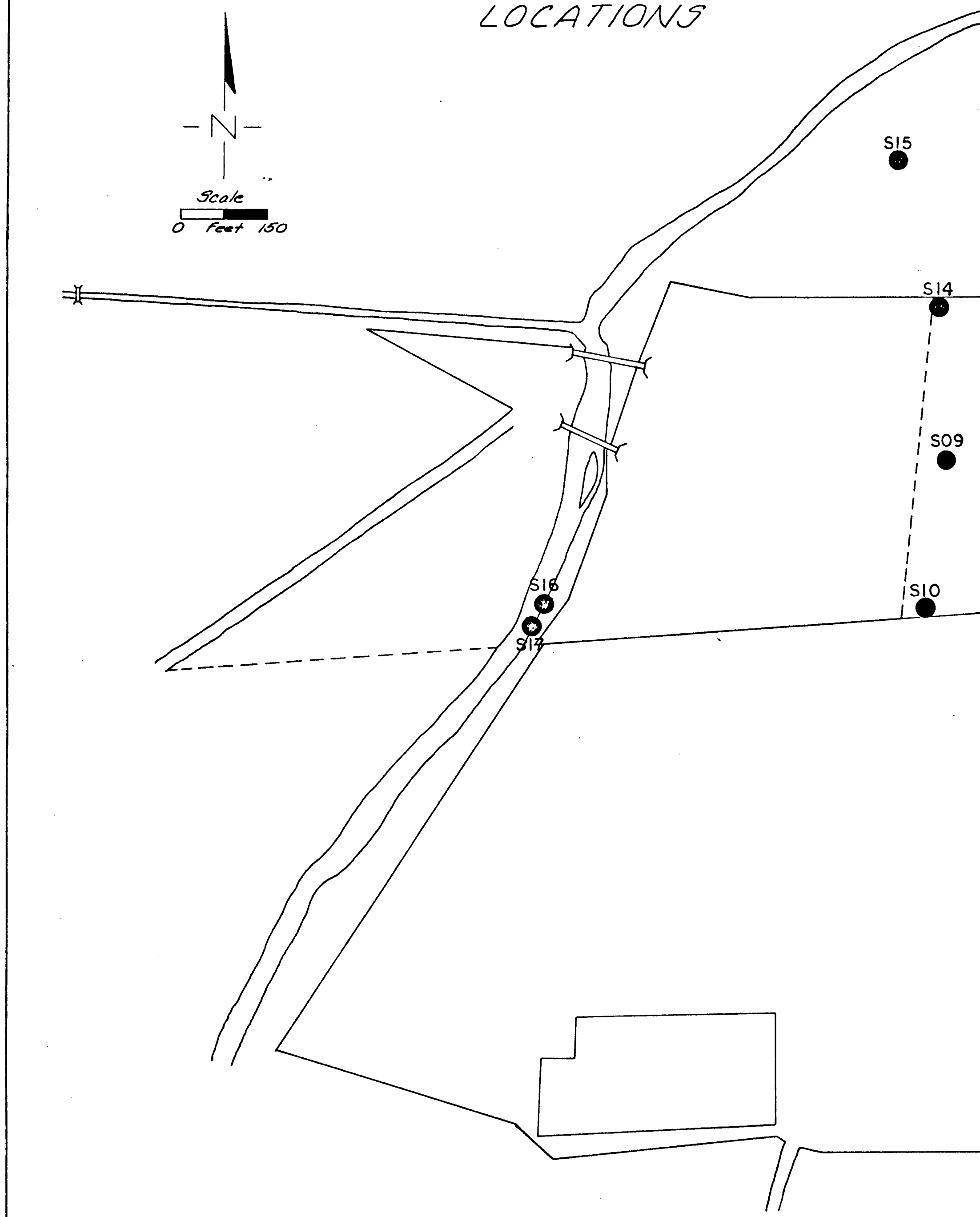
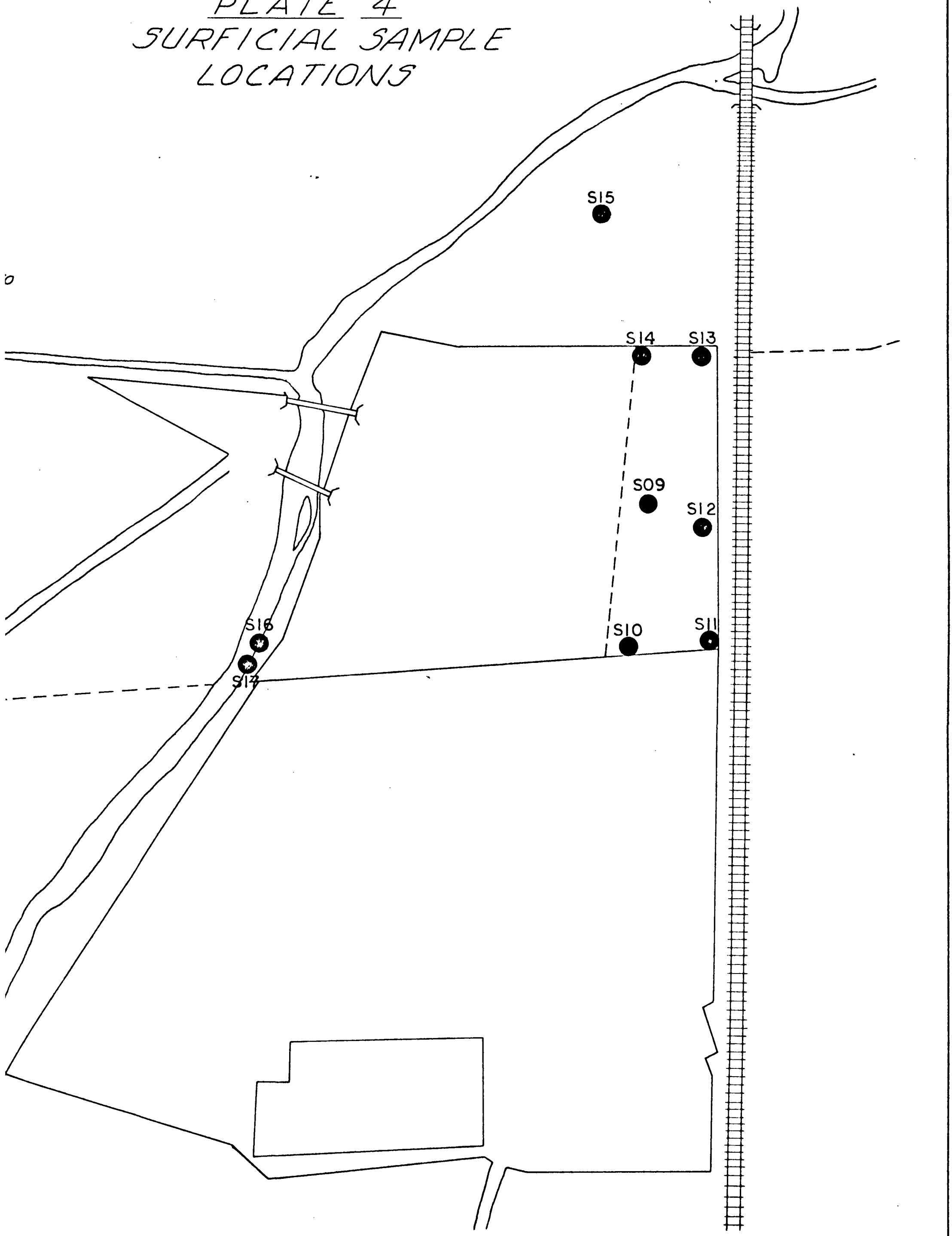


PLATE 4
SURFICIAL SAMPLE LOCATIONS



5

PLATE 5
WELL LOCATIONS

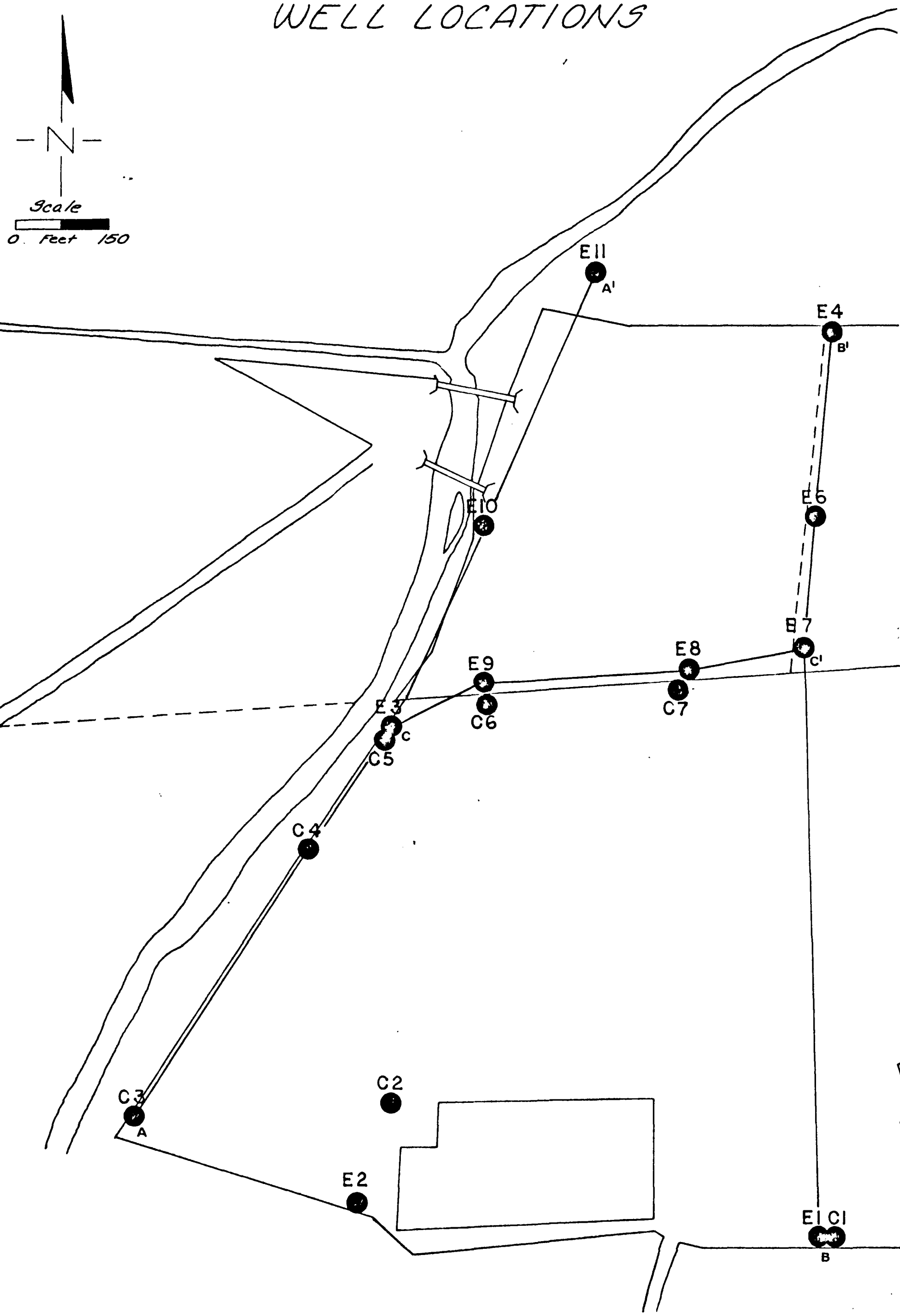


PLATE 5
WELL LOCATIONS

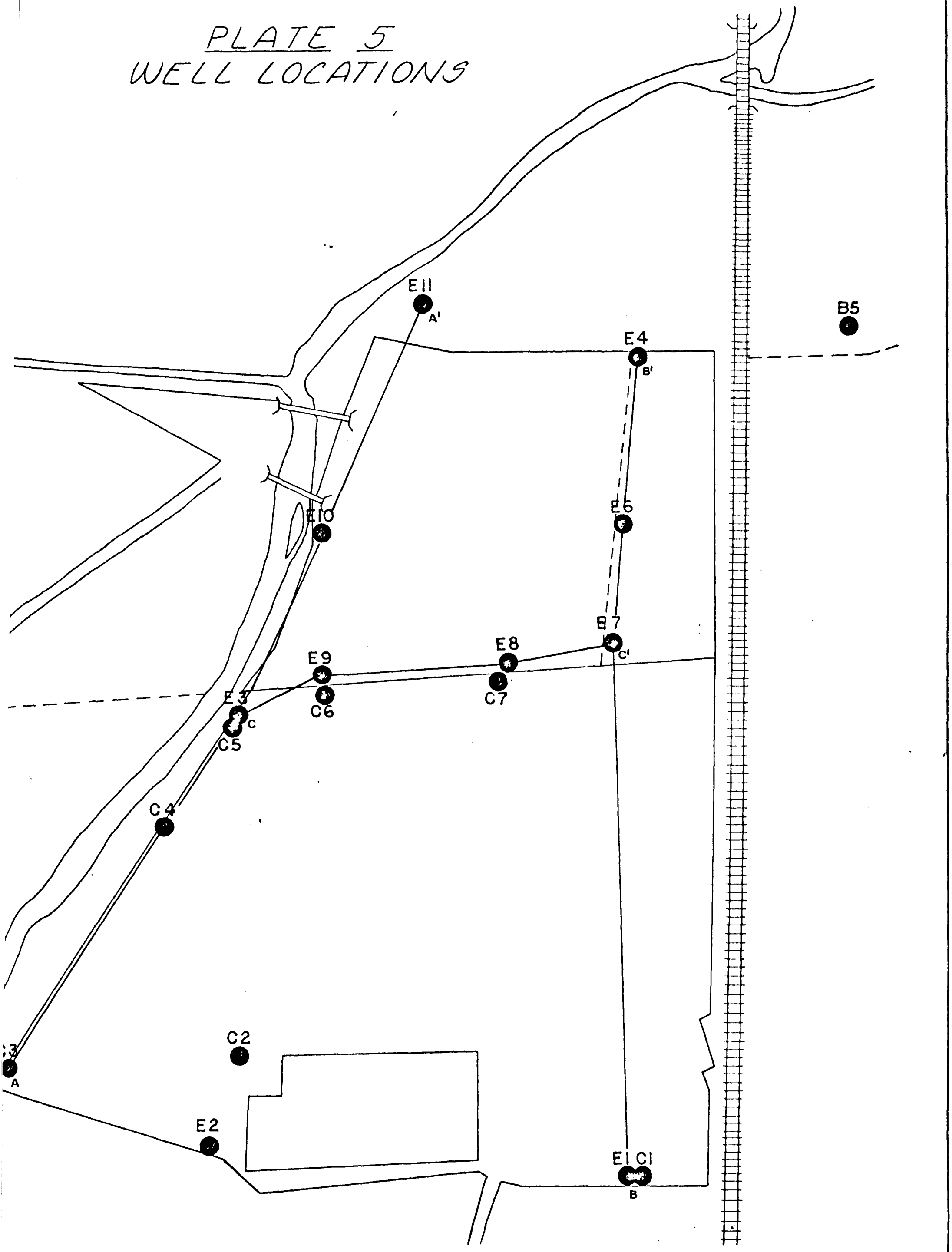


PLATE 6
POTENTIOMETRIC SURFACE MAP
January 19, 1981

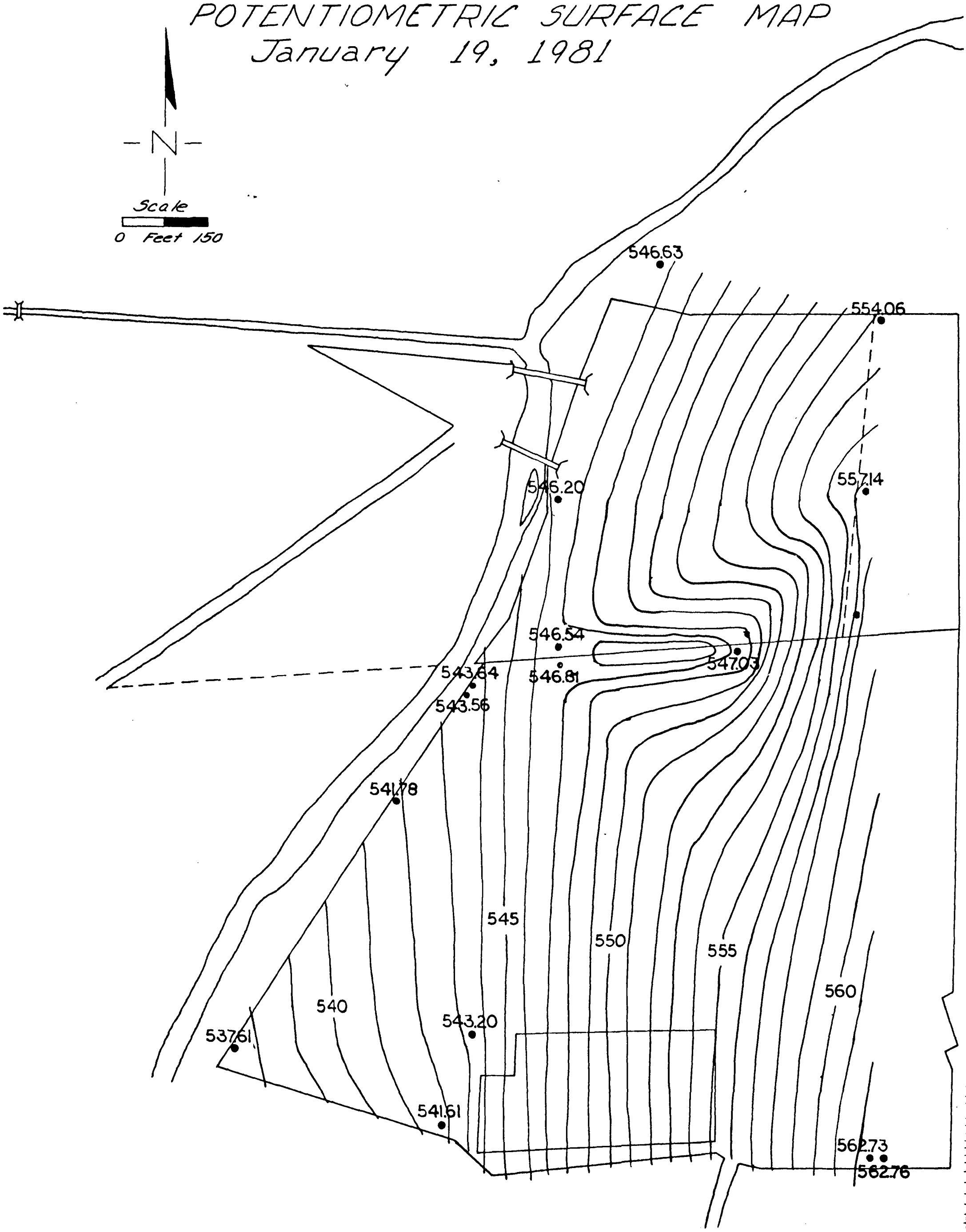


PLATE 6

)TENTIOMETRIC SURFACE MAP

January 19, 1981

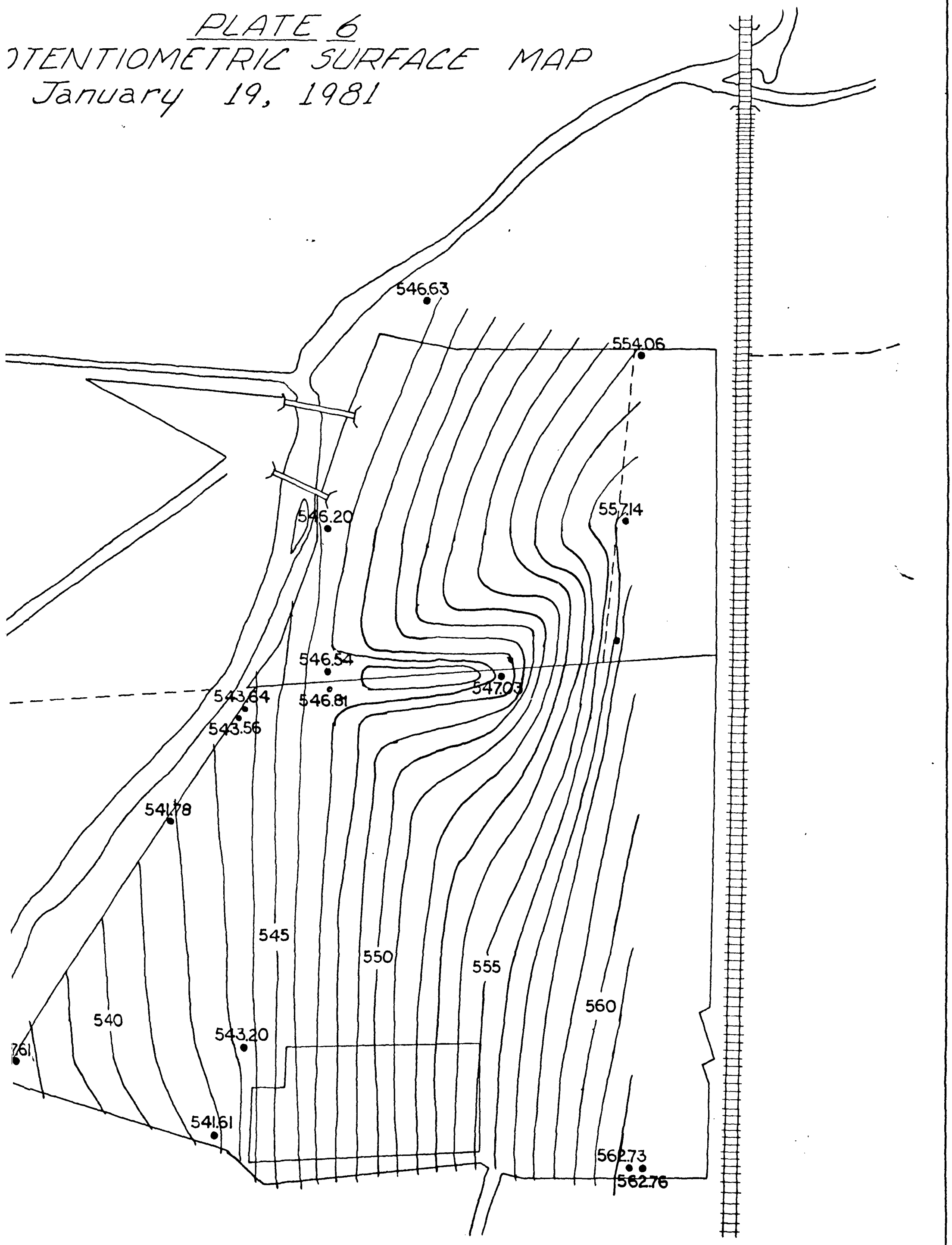


PLATE 7
POTENTIOMETRIC SURFACE MAP
December 8 and 9, 1981

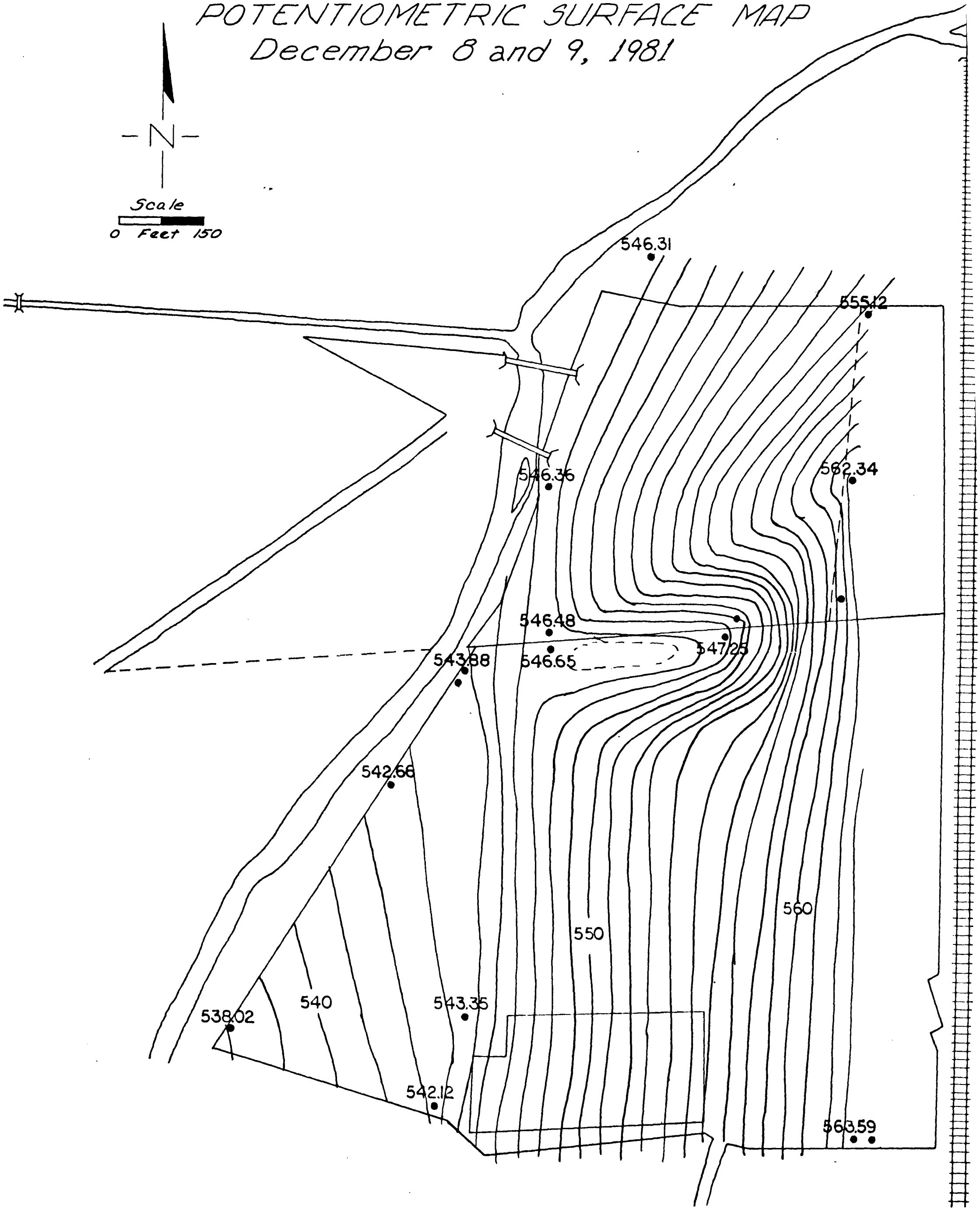
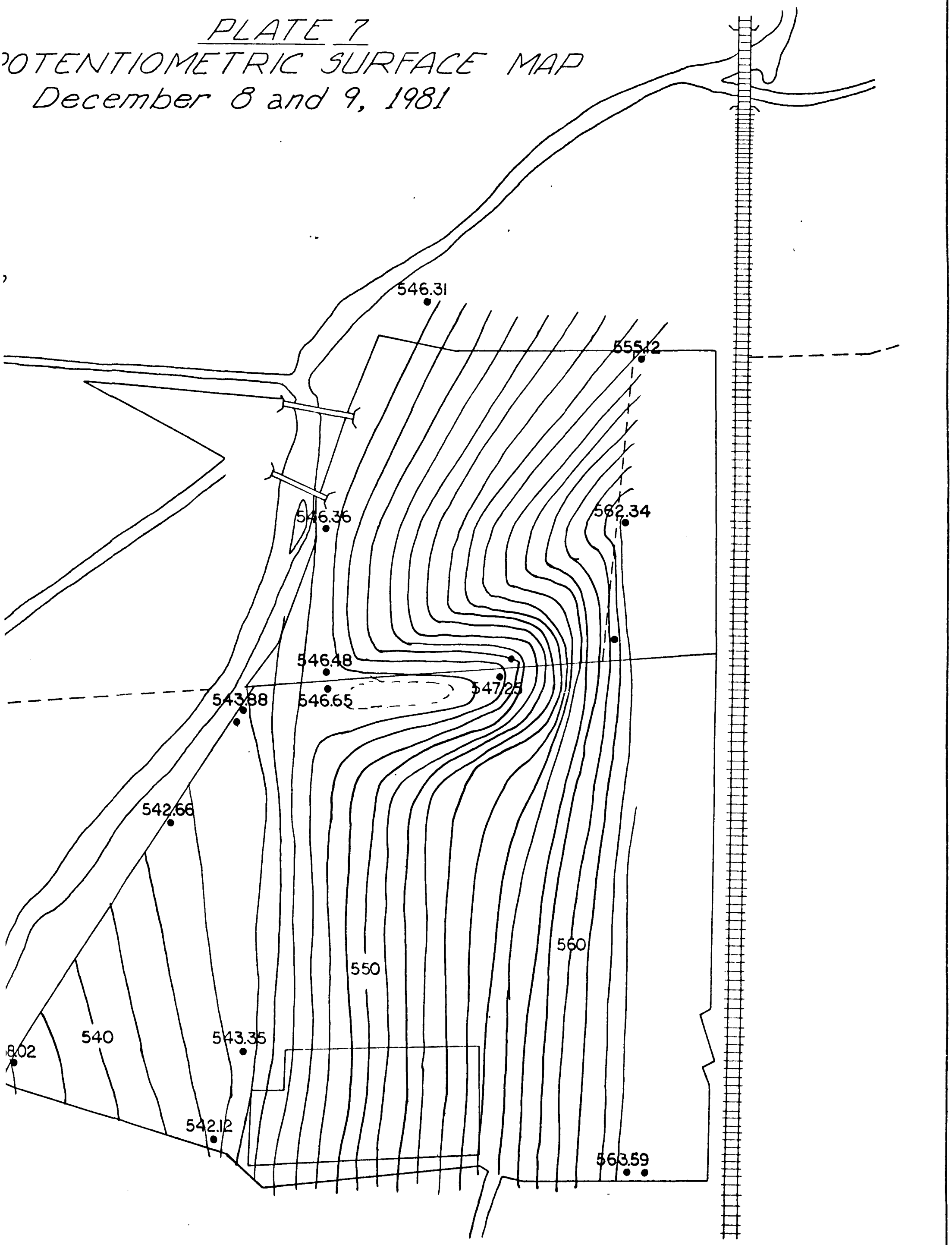


PLATE 7

POTENTIOMETRIC SURFACE MAP

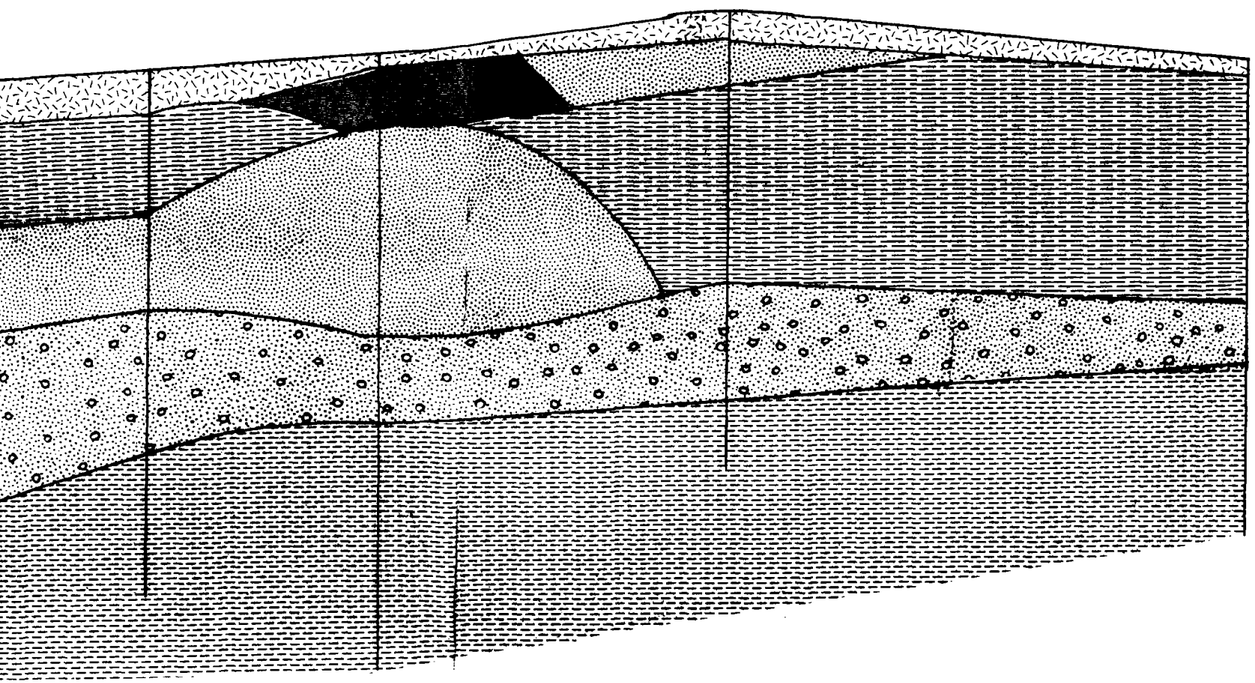
December 8 and 9, 1981

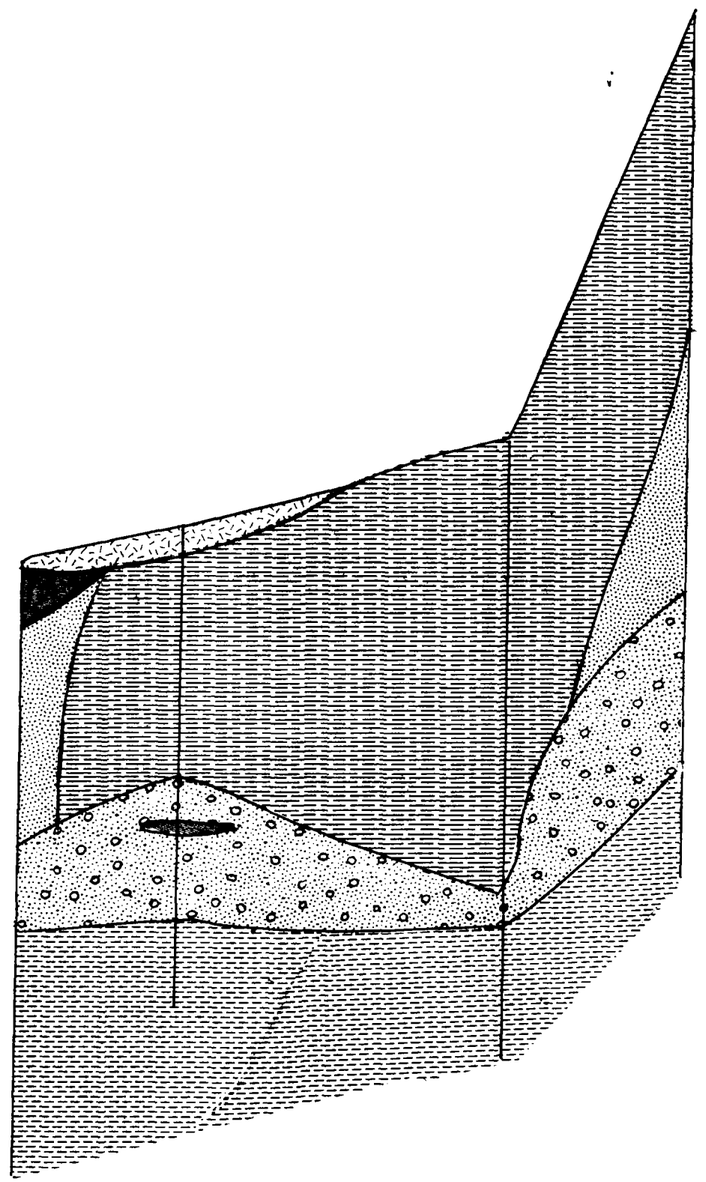


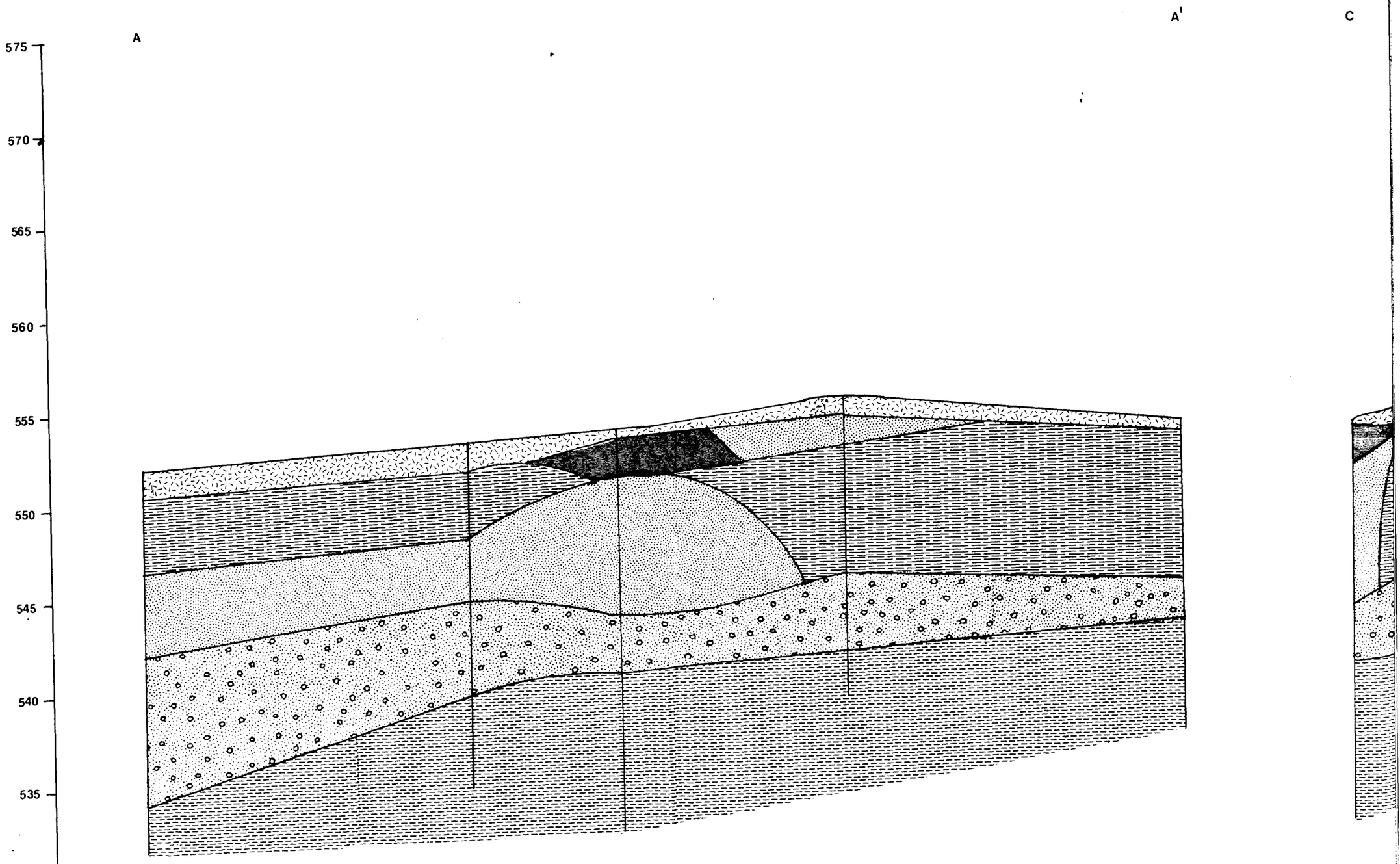
A'

C

C'






A
A'
C
575
570
565
560
555
550
545
540
535

B'

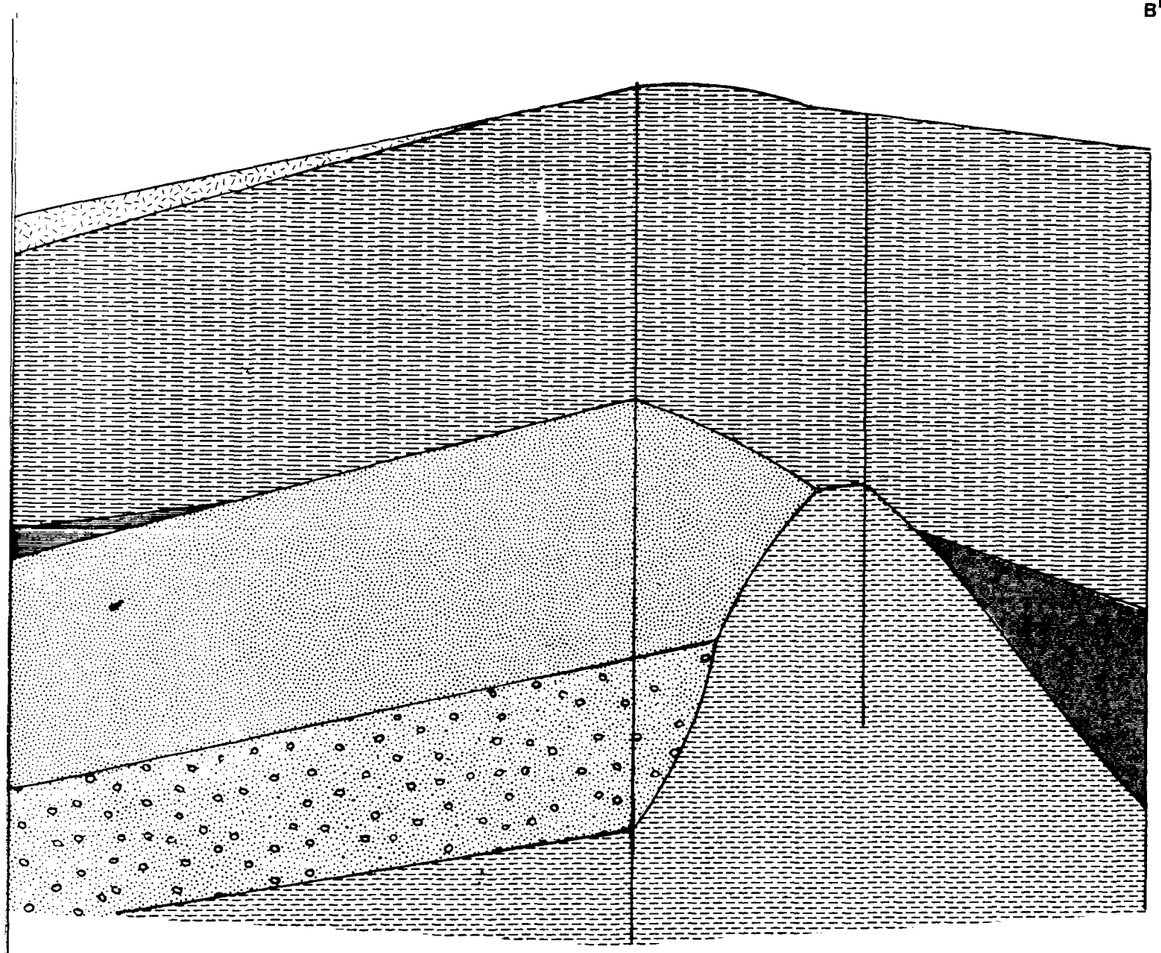


PLATE 8

CROSS SECTIONS

Topsoil or fill

Brown, sandy, silty clay w/ trace of gravel

Brown, medium sand w/ trace of gravel

Gray, silty clay w/ trace of gravel

Gray, medium to coarse sand w/ trace of gravel

Gray, silty clay

C

530

B

B'

575

570

565

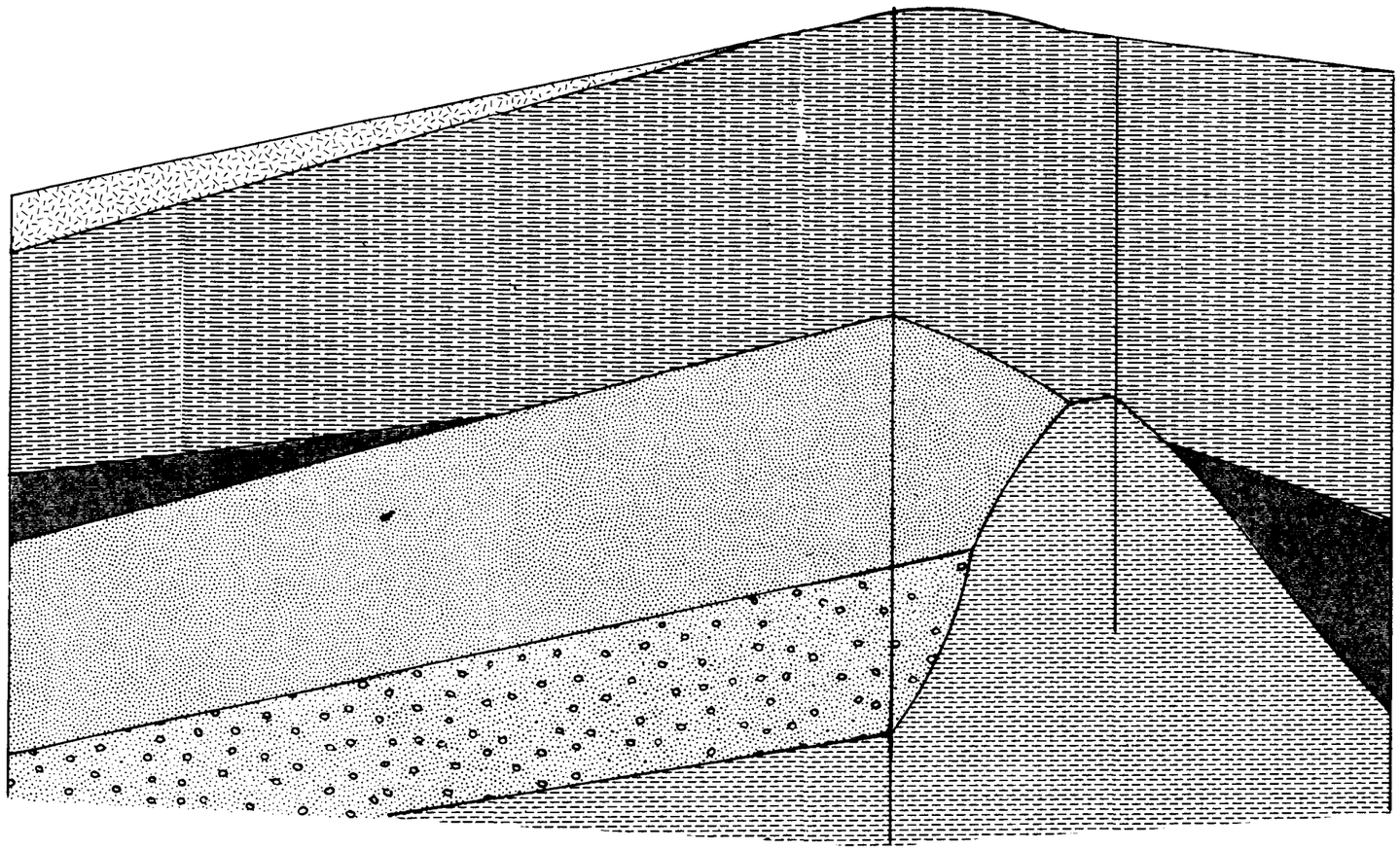
560

555

550

545

540



PL

CROS

Topsoil or fill

Brown, sandy, s
w/ trace of grav

Brown, medium
w/ trace of grav